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***A Network-based Framework for Strategic
Conflict Resolution***

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PhD Degree

98.

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Analysis***

***PhD Degree
1997-1998***

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November 12th 1997

Abstract

Strategic conflict in this work refers to the spectrum of co-operative and oppositional activities in which organisations engage when their interests meet. The origin of the work is in the management and prediction of corporate strategic conflict, but it will be seen that there are significant similarities between corporate struggle and that of international relations.

Following a review of the nature of conflict and the characteristics of strategic decision making, the work examines the effectiveness of three existing general approaches to conflict modelling and management, namely

- informal and qualitative methods;
- general systems analysis methods;
- and game theoretic approaches.

Desirable criteria for a strategic conflict management framework are derived and a framework is then proposed which has three components:-

Setting the future environment

The future of the organisation is described by a network of states of nature.

Resolving the Conflict

Within each of the states which represent the future, the options for participants are identified and the possible outcomes and interim states identified. An analysis of the influence and power of the participants over transitions between states is carried out, which indicates likely development paths in the conflict, from which conclusions can be drawn about both the likely outcomes, and about the actions which should be taken by a company to bring about preferred outcomes.

Closing the Loop

Feedback of information obtained by analysis and by contact with the real world back into the two structures described above allows examination of the effect of changing perspectives and the differing beliefs of participants.

The application of the framework is shown through case studies examining the justifiability and appropriateness of each of its elements and as a whole. These case studies cover both small and large companies, a variety of business conflict cases, both live and retrospective and draw on the recorded material in international relations for examples of non-commercial conflict.

Future development paths are identified for the concept.

Acknowledgements

I should like to thank the following people for their help and support during the course of this research.

Ian McFarlane for originally taking me out of engineering into the business environment and giving me the space to make mistakes from which I hope I learned.

Alison Wood and Karen Goldie-Morrison for providing the opportunity to put the techniques into practice. Without their trust it would have been impossible to apply the work to real-life problems.

Giovanni and Roberto Manunta for the unstinting generosity of their support for the ideas - right or wrong.

Robert Carlyle and Jeffrey Bradford for their critical support in the best academic traditions and to Robert in particular for his friendship throughout three hard and stressful years.

Murray Gell-Mann for his interest and inspiration.

Three supervisors:

Richard Miller, who stopped me shutting doors; Geoff Coyle, who stopped me opening doors; and Peter Allen, who pointed out doors I hadn't seen.

My wife, strong and forgiving.

My thanks go to you all; responsibility for the errors I keep to myself.

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Section I: Problem statement

Chapter 1: Introduction

***strategy and strategic conflict - background
objectives and aims
structure of the dissertation***

Chapter 1 – Introduction

This chapter provides a background to the problem addressed in this work. Detailed discussion of strategy and the strategic process are delayed until Chapter 2, but the nature of strategy and strategic conflict is discussed here in order that the problem addressed can be put into context, and the value of the work can be assessed. The research methodology of the study is delayed until Chapter 4, but the layout and general reporting approach is discussed here, as are the aims and objectives of the work.

Strategic conflict resolution is the process of reconciling the differing and often opposing interests between parties. Sometimes these differing interests can be accommodated within an essentially cooperative structure, such as an international alliance or a contractor-supplier relationship. Sometimes the differences remain, perhaps temporarily, irreconcilable, leading to situations of more direct conflict. This study covers both conflict and cooperation in this sense. The origin and objective of the work are in the strategic problems of commercial organisations, but it will be seen that there are extensive similarities between the approaches needed for the planning of industrial strategic action and those needed for the understanding of the behaviour of actors in international conflict.

Strategy and strategic conflict - background

Conflict

Conflict is often perceived as being either the absence of accord or as the engagement by two parties in joint action in pursuit of conflicting aims. Stagner (1967) describes it as *'... a situation in which two or more human beings desire goals which they perceive as being obtainable by one or the other but not both. ... there must be at least two parties; each party is mobilising energy to obtain a goal, a desired object or situation; and each party perceives the other as a barrier or threat to that goal...'* The energy to which Stagner refers is not necessarily that of physical energy. In a legal struggle, for example, plaintiff and defendant are not physically engaged in a struggle, but it is a battle nonetheless. *'... [A] relationship of quite genuine conflict may exist, even though none of the people behave in*

a manifestly violent manner..’ (Mitchell, 1981, p15). Mitchell goes on to observe the possibility of conflict being a state of mind among the parties rather than a state of action between them, and his tripod of situation, behaviour and attitudes provides the basis for a qualitative description method discussed below. We see this possibility of conflict being a state of mind rather than a state of activity in the planning process in business particularly. Two or more companies may be engaged in preparing for the struggle for a new market without actually being in contact within the market place. Similarly, the extensive low-level conflict surrounding the inner German Border for most of the latter half of the twentieth century can be seen as a conflict maintained at the potential, inactive state, but there was no doubt at the time that the western powers and the USSR were in conflict one with the other.

This work adopts Mitchell’s working definition of conflict as *‘Any situation in which two or more social entities or ‘parties’ (however defined or structured) perceive that they possess mutually incompatible goals.’* (Mitchell, op.cit, p17) Within this work we shall concentrate mostly on the particular social entity of the business organisation, but examples will be drawn from the conflicts between other social entities, particularly nation-states and on occasion, by way of amplification, between individuals. These goals can often be vague, and sometimes are perceived as goals only by subsets of the participants, or as they are often called in both international relations and business literature, the actors. Mitchell (ibid.) observes that *‘... circumstances of scarcity may arise both over material goods (oil wells, motor cars) and positional goods (roles as managers, permanent members of the UN security council), the latter being scarce in some absolute and final sense.’* We shall see in examples below, in both the international relations sense and in the wider context of industrial corporate conflict, that the embodiment of positional and material goals can take diverse forms. In a later example of the conflict between a government official and a potential blackmailer, the goal is not only non-material but is abstract; it took the form of a struggle over the very freedom of political action of the official ensured by freedom from a blackmail threat. Between two companies engaged in positioning for a major project the

goal takes the form at first glance of being positional, namely the establishment of a desired relationship on a major defence project, but on closer examination transmutes into the material goal of profit. We can see then, that the generally accepted groundwork of international relations in classifying and considering conflict, in this sense, is applicable as much to the struggle between corporations as it those between nation states.

Mitchell also observes that in the same way that one expects to see non-conflictual behaviour (i.e. cooperation, teaming, implicit agreement) between corporate entities, one also observes cooperative behaviour between the actors in international conflict (treaties, spheres of influence, trade). The conclusions are summarised in Table 1 below (Mitchell, op. cit. p24)

<i>'Pure situation'</i>	<i>Goals</i>	<i>Characteristic behaviour</i>	<i>Characteristic Inter-party attitudes</i>	<i>Characteristic relationship</i>
Conflict	Incompatible: (i) in different order of importance (ii) contradictory; mutually exclusive	Solely at own behest; blocking, resistant, interfering; cost imposing	Hostile	Enmity
Co-operation	Congruent: Identical, interdependent or complementary	Via consultation; concerted or accommodative; benefit-conferring	Friendly	Alignment
Isolation	Independent: No interactive effects; goals can be held simultaneously as none affects the other	None directed towards the other party	Ignorant or non-existent	None

Table 1 (from Mitchell, 1981) The characteristics of conflict, cooperation and isolation from an international relations perspective.

The definitions of conflict behaviour used in general conflict study are rather limited. For example, *'Action undertaken by one party in a situation of conflict aimed at the opposing party with the intention of making that opponent abandon or modify its goals.'* (Mitchell, op. cit. p29) Note here the assumption that the conflict is essentially between two parties or (optimistically) that it can be thought of as a series of bipartite engagements between

subsets of a larger actor group. There is no basis for this assumption, and we shall see later that it is not necessary to consider a multi-player conflict as a series of two-player conflicts; more sophisticated modelling approaches allow the wholesale inclusion of multi-player motivations and powers.

Neither is it necessary to make the assumption in Mitchell's work that the objective of one player is directly to confound the other. His definition quoted above must be taken to imply that each player is attempting in some way to break the will of the other, to '*mak[e] that opponent abandon ... its goals*'. It is not necessary to have such a narrow comprehension of objective, nor is it desirable: in many situations of conflict it is just as acceptable an outcome to have the opponent neutralised as it is to induce a fundamental change in the opponent's desires and objectives. In business, the imperative is more likely to be to make a profit than to act ideologically to change the competitor's value system. Moreover, it is not so simple in a multi-player game to achieve a direct opposition of wills as implied in Mitchell's definition. With three or more parties, each may have different objectives, so that the confounding of one may allow the third to gain what we want to avoid.

Strategic conflict, then, is characterised by the misalignment of objectives amongst a number of players in a situation where the outcome is significant to the players. If the result were not important it could not be judged as strategic, in the normally accepted sense of a significance which is more important rather than less to the participant, and which takes place over a longer rather than shorter period of time. If there were no misalignment of objectives amongst the players there would be no conflict nor any prospect of conflict.

Lastly, we observe, with Mitchell (op. cit. p33) that conflict is characterised by being dynamic, and that we must take into account that factors may change during the progress of a strategic struggle. First, the objectives of the players may change as their expectations alter and, indeed, as the understanding of the achievability of different desired outcomes grows. Second, the set of actors themselves may change, as some lose motivation to engage in the conflict at all, while others are stimulated into action by a developing situation.

Third, the relative strengths and capabilities of the players may alter. Fourth, the perceptions of the players about the struggle may alter with time. Last, the relationships between participants may alter over time.

Such an extensive embracing of what is meant by strategic conflict requires a similarly extensive and flexible dynamic model. Discussion of the capability of present methods to cope with such a concept is reserved until chapter 3.

Strategic planning

Strategic decision making is frequently represented as a developmental process whereby a company decides what it wishes to achieve, identifies where the gaps lie in its capabilities, produces a plan of action, and implements it. Pfeiffer (1991 - p xii), for example, offers the following summary flow chart for the process. *See Fig 1.* Gup, (1979 - pp 28-31) describes the three questions on which strategic planning should be based, namely, *Where are you going?*, *What is the environment?* and *How do you get there?*. In many respects this provides a very reasonable and workable framework for general strategic planning. It has the advantages of being well accepted in practice and being essentially sequential in approach; progress toward an action plan can be audited and measured.

As we shall see below, in a later critique of approaches to strategic decision making, there are difficulties in this focused approach. It is an assertion of this work that such a process is essentially limited by its preoccupation with the company whose strategy is under development, or as it will be called here, the client company. Examination of Figure 1 will indicate that attention is focused on those elements of the process about which much is known; our intent, our mission, our capabilities, our shortfalls, the impact of the environment on us, our plans, what we have to do. Such an approach is ethnocentric, also, in that it tends to assume that the values and objectives of others are either similar to or are extensions or reflections of our own. Often it is assumed that a competitor will act in opposition to our intent simply because of his status as competitor. Alternatively, assumptions can intrude

regarding the neutrality of an environment which is, in fact, in opposition to our intent. Sometimes the reactions of regulators or customers, particularly in oligopsonies, are inappropriately ignored. Like a pre-Copernican cosmologist it is all too easy to view our market and our industry as rotating around ourselves.

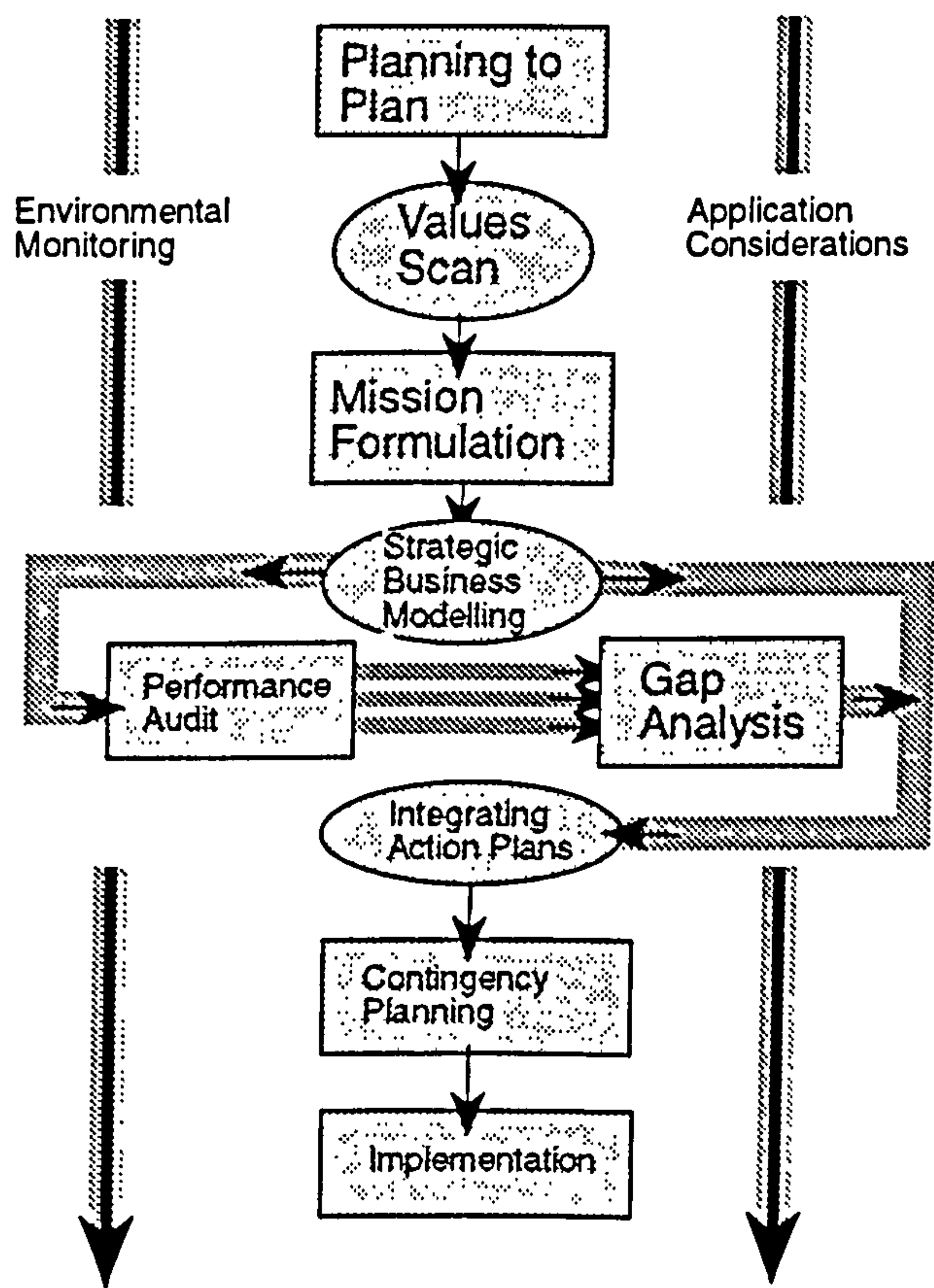


Figure 1: The Applied Strategic Planning Model
(from Pfeiffer, 1991)

This is particularly true of those business situations where we find ourselves in more or less direct confrontation with a competitor, a group of competitors, a potential partner, a customer or a regulatory body. Procedures such as Pfeiffer’s are followed and clear action plans result. We know precisely where we want to be and how to achieve it. All too often, however, other players have different ideas, and we find ourselves re-examining our strategic

models part of the way along the action planning path, in the light of unexpected behaviour on the part of other interested parties. What has gone wrong?

All too often our model of the struggle is centred on our own view of the contest. It is insufficiently rich in terms of examination of the world-view of the players, their objectives and, most importantly, their options in striving for success as they define it.

We shall see later that there do exist some techniques for addressing this type of interactive struggle. Some come from the domain of game theory, others from hard and soft systems analysis and others from a symptomatic approach to management science. Each have their shortcomings; those which are rigorous tend to be highly limited in applicability, and those which are widely applicable tend to be too general for application to specific strategic conflict problems. The purpose of this work is to provide the connective tissue between some of these approaches in order to develop a usable framework to allow these strategic conflict situations to be described and planned for.

The strategic conflict situations referred to here can be of a number of types and can be the object of interest of a number of organisational levels of an organisation. For example, at the highest organisational level of a company, a strategic conflict situation might be the merger with or acquisition of another company. There might be a number of prospective bidders, each of which may have differing objectives and influences, capacities and resources in the struggle for control of the target. Such a situation is clearly one of opposing objectives and intent and thereby constitutes a strategic conflict. At the beginning at least, the options for the players may not be clear even to them. In many cases the identity or existence of participants may not become apparent until late on in the development, and in some cases may not even be apparent after the event.

Another example of a strategic conflict situation is the struggle for a competitively bid major project. If the project is sufficiently important to the client company its winning will be seen to be strategic and, since the client company's options, objectives and view of the world will be opposed by other players, including the customer and competitors, who will

hold different views on what is desirable in the development of the opportunity, such a struggle can be considered a strategic conflict.

Lastly, a strategic conflict situation may not involve outside players necessarily. A third example of strategic conflict is the struggle for control of a company from within itself, either in terms of the ambitions of board level parties or individuals, or of divisions in a federated company. All these fall under the definition of strategic conflict used in this work.

Objective and aims

Under the working definitions declared in the previous section, then, the following aim for the research emerges.

Research Aim:

To provide an appropriate, justified technique for the predictive understanding of strategic conflict.

In order to achieve the aim the programme of work had the following objectives:-

- 1) Examine the characteristics of strategic conflict and the decision processes needed to plan for it.
- 2) Identify the desirable characteristics (criteria of goodness) for a strategic conflict resolution method.
- 3) Assess the appropriateness of existing methods of strategic conflict resolution against these criteria .
- 4) Propose a candidate **framework** for consideration.
- 5) Compare this framework against the criteria of goodness and assess its fit with the needs of major companies.
- 6) Develop the chosen framework to a working state by developing a

particular embodiment of the framework including its supporting techniques.

7) Test the individual supporting techniques and overall embodiment of the framework in practice. Assess the embodiment against the criteria of 4 above.

8) Make amendments and propose further development to the framework as appropriate in the light of the experience gained in the pilot studies.

Structure of the Dissertation

The aim of this dissertation is to show that the particular framework developed here (known as the foveal game approach) has a justifiable and appropriate embodiment for the predictive understanding of strategic conflict. Two novel techniques are used in the embodiment. The first, Extended Field Anomaly Relaxation (EFAR) is a futures scanning tool which sets the overall environment for the solution and description of the strategic conflict. The second, Powergraph, serves to provide operational/tactical solutions to the strategic problems presented. The two work together under the foveal game framework to provide both sensemaking and action planning products.

The dissertation has six sections comprising a total of eleven chapters and supporting material.

Section I - Problem statement

The present introductory chapter, Chapter 1, is the only chapter in Section I (Problem statement). It states the problem which is to be addressed in the research and provides only sufficient background for the initial understanding and valuation of the problem. Preliminary definitions of fundamental terms such as *strategy* and *conflict* are offered, again, to assist the reader in appreciating the problem statement.

Section II - Existing approaches and their failings

This section addresses, in Chapter 2, the strategic process as understood by writers from the contributory disciplines. Two particular viewpoints are adopted. First, the nature of strategic decision making and the uncertainties inherent in it are examined in order better to understand the context in which strategic conflict is placed. Clearly strategic conflict forms part of a wider strategic process, and it is this wider process which is discussed. Second, it is important to understand the contribution of rationality and this is examined in some depth. Lastly in Chapter 2 a set of criteria for a competent strategic conflict resolution method are derived, in order that the existing methods and the framework and embodiment derived in this present work, can be tested for appropriateness.

In Chapter 3 an extensive examination of existing methods is carried out. Various approaches and methods are tested against the criteria derived above, and an evaluation carried out of their appropriateness for the present task. There are three main areas of supporting previous work, namely economic game theory, hard and soft systems methods and the particular techniques of conflict resolution and metagames which fall between the first two in style of approach. The deficiencies of each are identified.

Section III - Methodological foundations

The single chapter in this section provides a foundation for the selection of a research methodology by firstly addressing the fundamental difficulties of strategic research, and in particular the problems of intervention and relativism and the consequent undermining of any logical positivist scientific approach. An appropriate research methodology is described which allows these fundamental difficulties to be circumvented and its particular implementation in this work is described with particular regard to the testing of validity both in terms of internal consistency of a method and the evidence provided by case work.

Section IV - A solution framework and its elements

Chapters 5, 6, 7, 8 and 9 are grouped into Section IV, the aim of which overall is to argue

for a conceptual framework for the solution of strategic conflicts and known as the foveal game approach. This conceptual framework is described in Chapter 5, and its emergence from the criteria of goodness derived above demonstrated. In particular the need for a strategic futures scanning tool is identified as is the requirement for a method of providing predictions of the behaviour of the participants in operational level structures.

The futures scanning requirement is fulfilled by a network based method of generating scenarios, known as Extended Field Anomaly Relaxation (EFAR). Chapter 6 described the origins of this method and shows its validity in practice by means of case study evidence.

Chapter 7 describes the central technique of the embodiment, Powergraph, and with extensive use of case work evidence shows its justification as a practical tool. Powergraph has itself a number of sub-techniques and these important elements are, similarly tested in the case study environment. Particular attention is paid to the nature of the product of the Powergraph process, which is both sensemaking and focused action planning. Chapter 8 describes a method of generating the discrete state structure necessary for the Powergraph method. Chapter 9 describes two case studies which provide evidence for the justification of Powergraph according to the criteria established in chapter 4.

Section V - A developed framework

The last chapter of the main body of the work is Chapter 10, which revisits the framework and the criteria of goodness in the light of the knowledge gained about the embodiment elements discussed in the previous section. These elements are now fitted together into an overall practical method, which is examined as an *ex ante* real-life case study of the strategic analysis and eventual action planning for a medium-sized media company. This case study shows how the overall foveal structure supports the specific embodiments of the strategic multi-futures method, EFAR and of the conflict modelling and management technique, Powergraph. In Chapter 11 the case study evidence described in the previous chapters is used in conjunction with the overall study of the media company of Chapter 10 to justify

the overall approach and to illustrate its strengths and weaknesses. The justification is based upon criteria derived in Chapters 3 and 4.

Section VI - Supporting material

This section contains annexes containing detailed supporting material from the case studies and the list of references.

Section II: Existing approaches

Chapter 2: The strategic process and its requirements

nature of the strategic decision

strategic rationality

criteria for strategic decision support

Chapter 3: Existing approaches and their shortcomings

the international relations approach

systems approaches

game theory approaches to conflict

multiple futures planning

summary of potential contributions

Chapter 2: The strategic process and its requirements

Introduction

The aim of this work is to develop and validate a methodology and underlying techniques to assist with the understanding of and management of strategic conflict. In order to do this we need to understand the nature of decision making at the strategic level, since, to the extent that the strategic process conditions the requirements of its supporting techniques, we must work within the practical and theoretical constraints of that process. This implies an examination of the aims and extent of strategy, its necessary processes – i.e. its rationality – and the components of that rationality. This chapter is divided, accordingly, into two main parts.

The first deals with the strategic process itself and will examine the current state of thought regarding the nature and process of strategic decision making.

The second deals with the critically important issue of rationality in decision making in order that subsequent work in describing and conditioning behaviour can be well-founded.

Lastly, from these connected examinations emerges a set of characteristics which are desirable in the support of a strategic decision making process, and this set of characteristics forms the benchmark for subsequent examination of current approaches and the developed approach which is the subject of this work.

The Nature of the Strategic Decision

There are many models of strategic thought, both within the business community and the corps of practitioners and academics. In the main part the differences between them are those of viewpoint and emphasis rather than in the product, since strategy is, in a sense, self-defining — it is what the heads of organisations concern themselves with — it is what strategists are told to think about by their CEO's. This view is in contrast with the widely-

held position that corporate strategy is concerned with the long term, the broad sweep of history and the global struggle for markets rather than the tactics of business. Rosenhead (1989) is of the opinion that '*one key distinction between tactical and strategic situations is the uncertainty so characteristic of the latter*'. There is no doubt that strategic decisions are made under conditions of uncertainty, deception and error, and we will discuss the nature and extent of that uncertainty later in this chapter, but two preliminary points must be made regarding the tactical component of corporate decision making.

First, tactical decisions, too, are subject to error, deception and uncertainty. The context in which decisions are made is changeable; staff move and take their costly world-views with them; the very objectives of the corporation shift and change under the sway of short term stock-market pressures and long-term barely-felt geopolitical currents. Often the tactical decision-maker is unaware of the changes in the environment in which he is making his decisions either because of shortcomings in the communication and decision-making ability of the organisation around him, or because the speed with which tactical decisions have to be made and the geological creep of the strategic context are incompatible.

Second, tactics condition strategy. Without the existence of projects to ensure the cash-viability of the corporation or to provide the development vehicle for increased competitive advantage, there can be no strategic position to adopt. This is particularly so in 'granular' corporations which are dominated by projects each of which (or many of which) form a large fraction, say 10% or more, of the turnover of the company. It is a different case where the company's business structure consists of a plethora of small projects none of which *per se* is essential; but even in this case the aggregation of projects into managed market sectors, lines of business (LOBs) or skill areas effectively agglomerates these to give the effect of a granular company. Frequently, the tactical situation on a major project will condition the behaviour of the company in respect of the potential conflict inherent in deciding whether to compete with a fellow team member on a new and critical project. One might argue that the distinguishing characteristic of tactics with respect to strategy is that tactics are short-lived whereas strategy is long-lived (or at least long-sighted). This

would be unsound, since in many cases either the major projects, in the case of the granular company or the aggregated projects forming the business sectors of the conventional company, have a decision lifetime which is at least as long as the ability of the strategist to predict the context in which strategy has to be designed and implemented. In other words, the stability of the decisions and the *weltanschauung* of decision-makers within a major project, stemming from the nature of the contract and the inertia of the design or production process in train, is often as great as the stability within the strategic decision-making structure and of the *weltanschauung* of the strategy makers. In this latter, strategic case, the stability stems from the extended time horizon under consideration and breadth of admitted solution-set rather than the existence of long-term internal stabilising factors such as the contract and the work in progress.

Figure 2 illustrates the point. It is the methodology of a typical strategic process from a major international company, which exhibits the commonly used divergent-convergent approach coupled with a layered examination of successively more tactical areas of attention. (The notes on the diagram give examples of the different stages for the reader). It sets corporate imperatives in the box marked 'Strategic Position Level' and then examines the implications of those corporate imperatives on a number of broad market positions at the next level down. Each of these market positions is assessed for compatibility with the corporate imperatives and for desirability according to feasibility and financial performance criteria. In order to assess the desirability of each position, the lines of business (LOBs) which comprise the position need to be assessed, and, similarly, at the lowest level of this process, the projects which comprise the LOBs need to be examined and appraised. This is a typical example of a strategic process which attempts to reconcile the need for an expansive long-sighted view, both in market terms and in time-horizon, with the need for firm underwriting of strategy by realistic project foundations.

The strength of such an approach is in its exhaustiveness and discipline. If implemented in its full form it is not unlike the methods used in the system engineering of complex safety critical systems (from which area it did, in fact, originate) and like those methods it is an

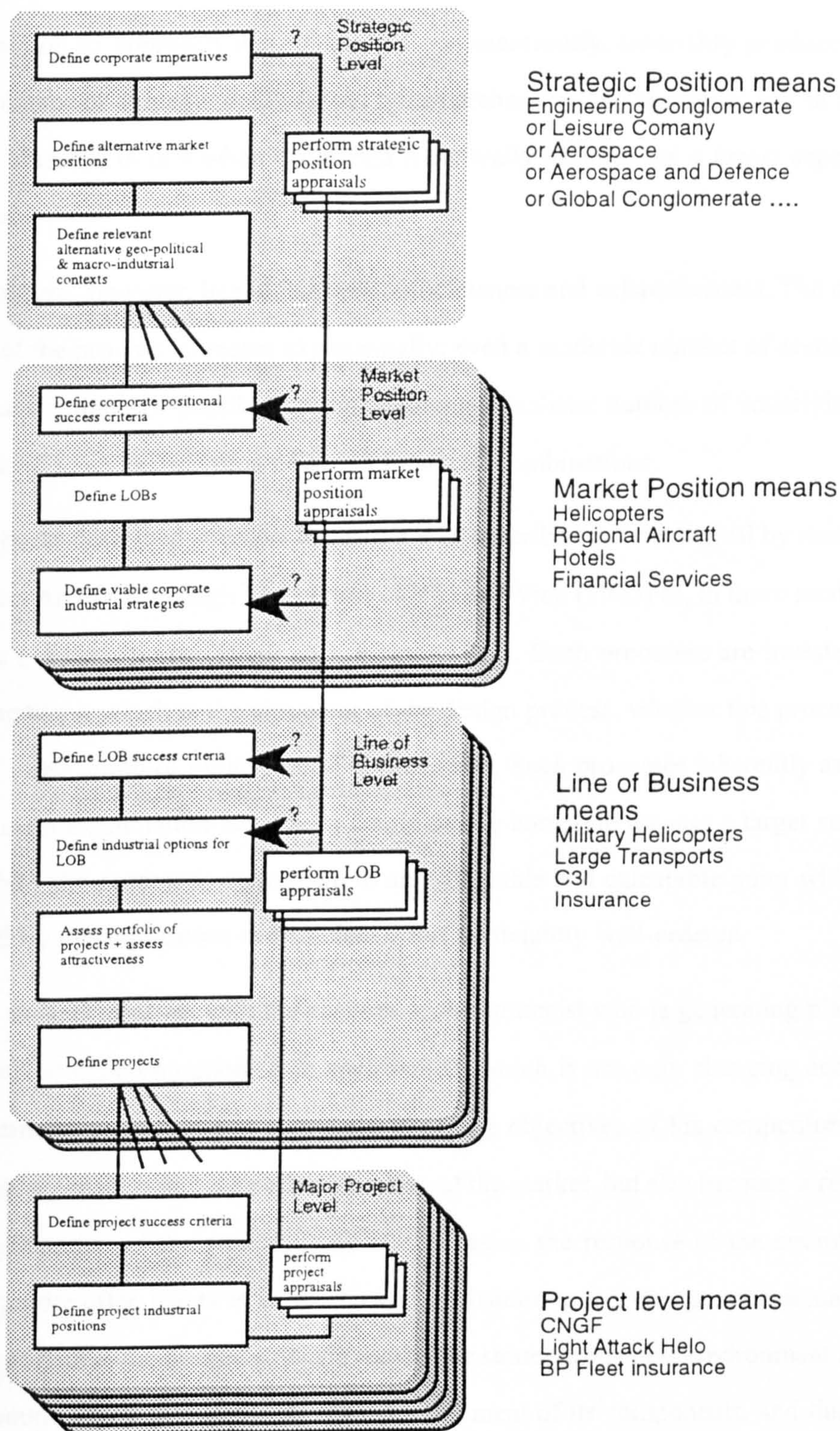


Fig. 2: Large company strategic approach showing layering (Marsh, 1995)

example of an approach that, if applied conscientiously, invariably produces a system performance or strategic analysis that is comprehensive and thorough, and in at least one sense 'correct', in that when completed it generally satisfies the *a priori* expectations of the user.

Its weakness, however, lies in this very completeness and exhaustiveness. The content and scope of the process increases exponentially; even a moderate number of scenarios with a moderate number of possible positions having a realistic number of underlying projects could lead to an examination of over a thousand combinations.

The process described attempts to act in a way described as teleological by many authorities from Aristotle through Maupertuis (1751) and Vico (1965) to, in more modern times, Huxley (1873), Planck (1960) and Fichte (1982). Such processes are invested with an ultimate target which is the aim point of the design process, whether this process is theological explanation or philosophical construction. Such processes inherently assume that if sufficient examination is made in a sufficiently complete manner a target state can be achieved - the process is convergent to an achievable and calculable point which can be reached by the application of sufficient effort sufficiently well-ordered.

This is in stark contrast with the position of the strategist who is generating plans for the evolution of his corporation in an environment which is not only changing according to the internally generated and constantly changing objectives of his competitors and, indeed, policy-makers and the collective whim of the market, but also because it responds to the implantation of the strategy itself. On occasion the response of the environment is neutral; more often it acts as Lenz's Law in opposition to any change; occasionally it acts so as to reinforce the desired strategic result. The strategic business environment is inextricably bound together with the strategic development of its components, and this is especially so in the case of the oligopoly, where the degree of expenditure of each player on examining the behaviour and objectives of the others is high.

'Teleology assumes that order must have a consequent purpose, which is planned' (Barrow (1986)) and is in contrast to eutaxiological constructs which argue that *'...order must have a cause, which is planned'*. The distinction is not a trivial one, and is highly relevant to the design of strategic decision-making structures. Rittel (1973), for example distinguishes between 'tame' problems which can be specified in a form agreed by any relevant parties ahead of analysis and which does not change during analysis, and a 'wicked' problem which is ill-defined. Rosenhead (1989b) cites two sets of characteristics for paradigms of problem-solving in OR, and it is worth reproducing these here overleaf in Tables 2 and 3, in full. Inherent in many of the clauses of Rosenhead's Table 3 is the concept of an eutaxiological decision methodology which, because of its acceptance that a fixed objective probably cannot be defined satisfactorily at the beginning of the process, let alone reached in practice, respects the uncertainties in the environment and attempts at any point in the decision process to act in such a way that if the objective remained fixed its point-to-point behaviour would be convergent to that objective, but that if the objective were to move, its point-to-point behaviour would be convergent to that new objective. Such a decision system acts in a 'good' way rather than seeking for the 'best'. It is the quality of the journey which is weighed continuously in the balance rather than the achievement of a specific pre-declared objective. Checkland (1981) approaches the concept of eutaxiology but stops short at the more restricted concept of teleonomy, which he describes as *'A neutral term indicating that developments may be described by an observer in terms of the ends served by them.'* He draws the distinction between 'purposeful' (teleological) behaviour and 'purposive' (teleonomic) behaviour.

Strategy, then, is concerned with survival issues of the corporation. In general it will concern itself necessarily with longer term, sometimes dimly viewed, objectives, but on occasion the close coupling of critical tactical issues will inevitably draw the attention of the strategic decision making body into considerations which are short term and fast-moving.

The strategic process, however, is not determined entirely by the external issues facing the corporation; we must turn to the connections between strategy and organisation in order to

1.	Problem formulation in terms of a single objective and optimisation. Multiple objectives, if recognised, are to be traded-off on to a common scale.
2.	Overwhelming data demands, with consequent problems of distortion, data availability, and data credibility.
3.	Scientization and depoliticization, assumed consensus.
4.	People are treated as passive objects.
5.	Assumption of a single decision maker with abstract objectives from which concrete actions can be deduced for implementation through a hierarchical chain of command.
6.	Attempts to abolish future uncertainty, and pre-take future decisions.

Table 2: Characteristics of the dominant paradigm of operational research (after Rosenhead, 1989, p 12)

1.	Non-optimizing; seeks alternative solutions which are acceptable on separate dimensions, without trade-offs.
2.	Reduced data demands, achieved by greater integration of hard and soft data with social judgements.
3.	Simplicity and transparency, aimed at clarifying the terms of conflict.
4.	Conceptualizes people as active subjects.
5.	Facilitates planning from the bottom-up.
6.	Accepts uncertainty, and aims to keep options open for later resolution.

Table 3: Characteristics for an alternative paradigm (after Rosenhead, 1989, p 12)

see into the effect of internal constraints and mandates upon the strategic process.

Decision Making processes

No discussion of strategy in organisations would be complete without a review of the processes of decision making itself. Inevitably the process model both describes and constrains the rationality of the decision maker and provides the basis for judgement of the behaviour of other participants in the strategic struggle. Without an understanding of the process of decision making itself, we cannot hope to mobilise knowledge of our opponent's decision making in our favour.

Following Noorderhaven (1995), we compare firstly a generic conceptual model of decision making with the well-known normative-rational model, and then describe four types of organisational strategic process. Noorderhaven's model consists of eight activities arranged as shown in Figure 2. It follows the conventional models of decision making, starting with an awareness phase, which may be compared with Friend's (1989) *shaping* phase of his *shaping-designing-comparing-choosing* model. This is then followed by an analysis phase (encompassing the remaining three phases of Friend's model) and then moves into an implementation phase. It accepts the recursive nature of the process in that, for example, the choosing can affect the perception of the environment of the first phase of the process. Similarly the implementation issues are kept in mind at the analysis stage in evaluating options. It is noted here that the decision itself is essentially defined by the decision maker; it is externally required, but internally framed.

The distinction between Noorderhaven's model and the normative-rational model of figure 4 is clear to see. The latter starts from an instrumentally-rational point with the goal being set externally at the start of the process. Sensing and evaluating of the context is carried out only in the SWOT stage. The model is widely used in industry (Huff & Reger 1987; David, 1991; Hitt & Tyler 1991; Grant, 1995; Hax and Majluf, 1996 pp26-29; Bowman and Faulkner, 1997).

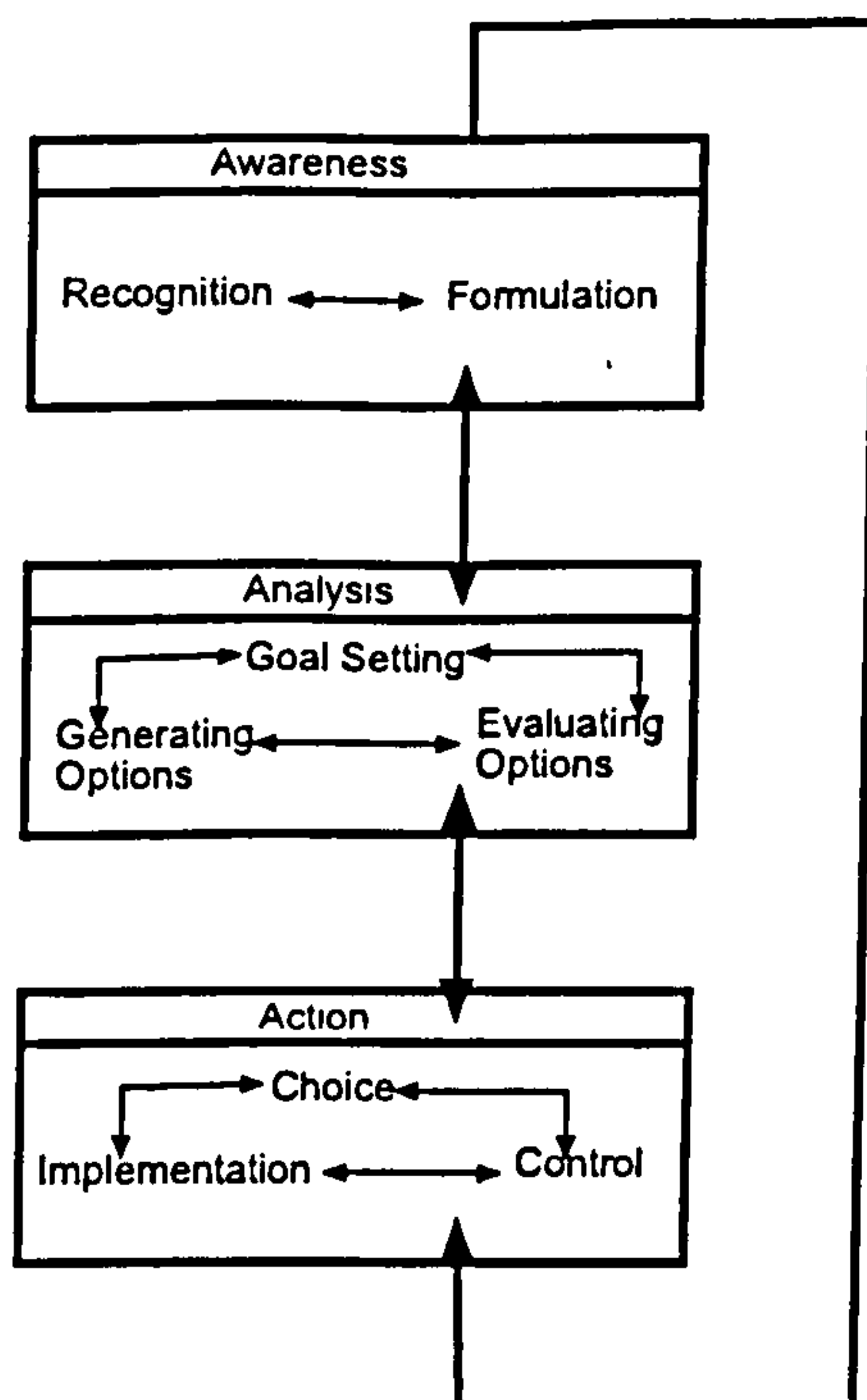


Figure 3: Noorderhaven's developmental model

The distinction between the two models bears greatly on our view of decision making in the organisation. Note that the process model of Figure 3 includes the setting of the goals as part of the process, whereas the normative rational model of Figure 4 has these set as a starting condition. Consequently the perceptions of rationality within the respective organisations will be different.

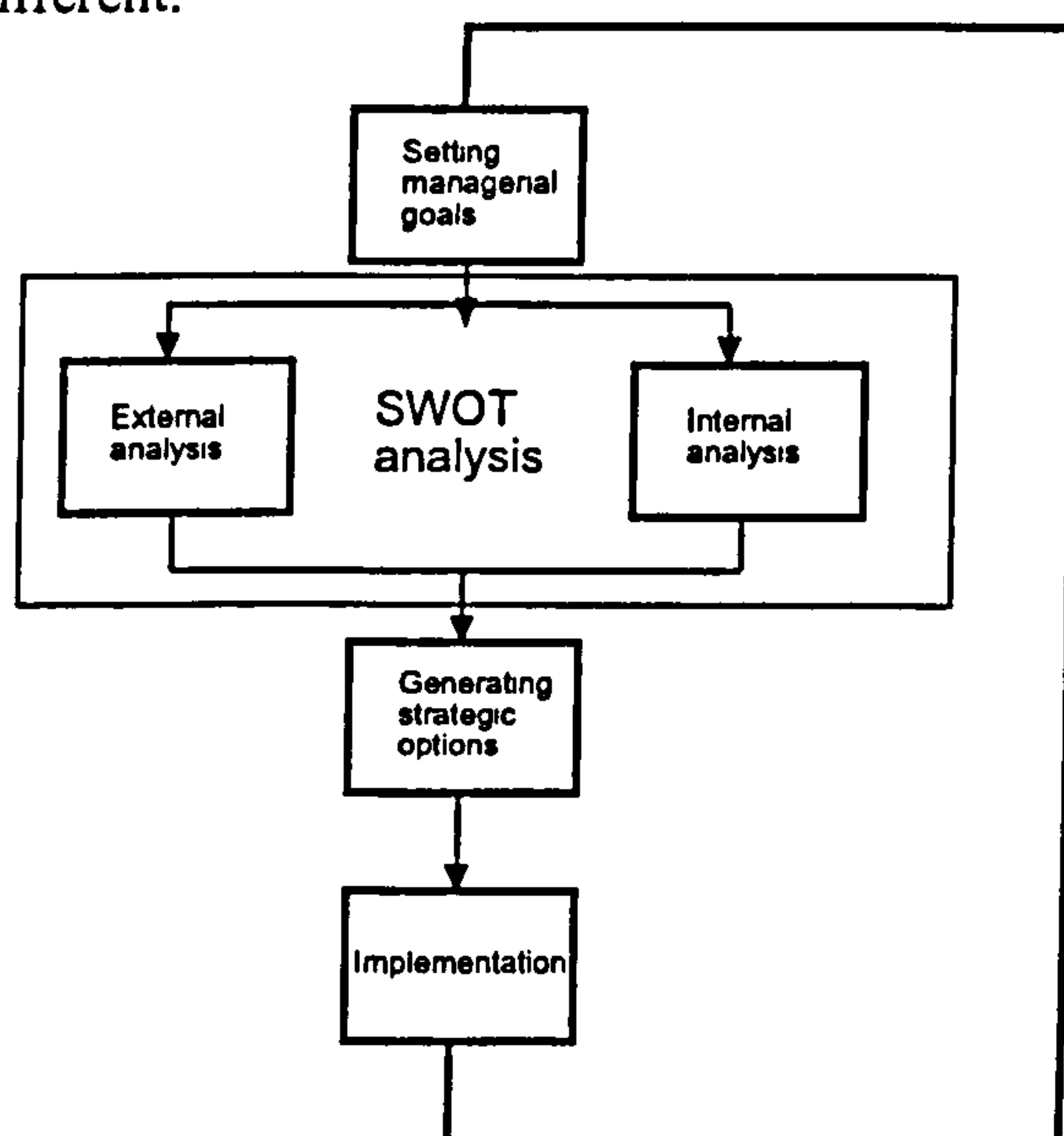


Figure 4: The normative-rational model

Four conceptual models of organisational rationality are generally identified, namely synoptical planning, disjointed incrementalism, logical incrementalism and the interpretative approach

Synoptical Planning

Synoptical planning has two main components, the design school and the strategic planning school. It gets its name from the concept that top management should periodically weigh up the situation in which they find their company and engage in an episodic process of strategy generation. It is thus open to all the criticism which the social process critique and, particularly, the structural power critique bring to bear.

The design school

This approach emphasises the importance of top-down decision making and the role of the CEO (Mintzberg, 1990, 1994) (Christensen et al, 1987). Lower levels in the organisation, the strategic support staff, divisional managing directors and others are viewed merely as support staff who may carry out analysis and implement the results of the strategy, but are the mere drones and worker bees to the CEO queen.

There are certain consequences. The strategy must be made visible to the contributors, but on the other hand it must be sufficiently simple to be kept in the mind of a single person, the CEO. Implementation and formation of the strategy are separated. The process of learning by the organisation as discussed by Argyris (in (Shrivastava, 1983)) is distinctly hindered, and the cognitive biases reported by Barnes (1984) remain unfettered by the checks and balances of a strategic group. Mintzberg (1994) characterises the design school as follows:-

Strategy making should be a controlled and conscious process

The CEO is the strategist

The strategy making process should be kept simple and informal

Strategies should emerge fully developed

Strategies should be made explicit.

Strategic Planning School

Here (Hofer & Schendel, 1978; Ansoff, 1987; Mintzberg 1990, 1994; Mintzberg et al, 1998), the process is a highly formalized and ritual elaboration of the similar design school process. The distinguishing feature with respect to the eutaxiological, adaptive approach is that the assertion of the strategic planning school that the development of the firm is controllable in the long term. Information on and prediction of the future is limited only by the skill and effort applied, and so the strategy emerging is the product of an essentially deductive process. It is therefore highly rational in a conventional sense and to the extent which it fails the tests of rationality, it fails as a strategic decision making process. It is highly teleological; it places clear and unambiguous objectives and goals, and the ability to achieve these goals is limited only by the intellect of the strategist. Ansoff's (1975) study of corporate strategy, for example, is based on this approach, and exemplifies the algorithmic nature of decision making of this school well. He shows (ibid. p. 74) charts and taxonomies of objectives, flow charts of decision processes (ibid. p. 146) and self-observant diagnosis charts (ibid. p. 219) all of which characterise the school.

Disjointed incrementalism

The bounded rationality perspective on decision making within organisations is embodied in the disjointed incrementalism of Braybrooke and Lindblom (1963) (Lindblom, 1959). It is essentially descriptive rather than prescriptive. Managers are assumed to have control and perception only of their immediate areas of responsibility. Moreover, any attempts to

operate on and predict any future is assumed to be infeasible. The future is as unknowable as the operating characteristics of the next department in the organisation chart. The result of this conscious organisational and temporal myopia is to approach strategic development incrementally. The organisation has no choice but to step cautiously from tussock to tussock across a misty swamp of internal and external uncertainties. Braybrooke and Lindblom (ibid.) summarise the disjointed incrementalist approach:-

Choose as relevant objectives only those worth considering in view of the means available or likely to come available in the immediate future.

Contemplate means and objectives at the same time

Limit attention to alternatives that differ only incrementally one from the other and from the present situation or policy

Evaluate alternatives only in terms of their incremental effects with respect to present policy or situation.

One particular pathological form of the disjointed incrementalist approach is the 'garbage can' model where the organisation is unaware of its technology, its goals and its processes. In this model the organisation reacts opportunistically to the random and fortuitous juxtaposition of perceived, transient goals and ephemeral solutions. It is an organised anarchy.

The disjointed incrementalist approach in both its forms can appear essentially irrational in the orthodox sense from outside it, but to members of the organisation the approaches, processes and effects may not seem so. Judged according to its own lights, they may seem logical, clear, logically well-connected and acceptable to the senior management. Rationality is what rationality expects.

Logical incrementalism

Logical incrementalism was developed during the late 1970s by JB Quinn (1978, 1980) as an attempt to improve upon the synoptic model so as to incorporate the intuitive aspects of

decision making into a more flexible process (Quinn, 1978, 1980). It has become a flagship of the learning organisation movement, advocating double-loop learning by organisations about their environment and themselves. (Quinn and Mintzberg, 1992; Mintzberg et al, 1998pp101-102)

In Quinn's conception of decision making the decision makers within the organisation are bound to act in an essentially intuitive manner because it is in the nature of the strategic problem that there is no recipe for solution. Moreover the very rules of approach and the critical characteristics will be markedly different in one case from another.

Quinn also admits and even encourages the operation of subsets of the organisation as change agents. Each sub-community has its own agenda, tempo, capabilities and information and will react accordingly. Ansoff's weak signals (Ansoff 1975) are made easier to detect because the disparate parts of the organisation share sensed data. Shared signals will amplify within the organisation to give an efficient distributed sensing system, by virtue of the association of different subsystems to the declared strategic imperative.

The cost to the organisation of this sensitivity and flexibility is that the logical incrementalist approach can lead to disjointed strategy. Strategy appears almost as a Darwinian emergent property of the organisation, but there is no guarantee that the criteria for onward selection at the subsystem level is compatible with or convergent to the global criteria for strategic success (assuming such criteria exist).

The logical incrementalist approach can be summarised as follows (after Noorderhaven, 1995)

Effective strategies for the organisation as a whole emerge from the partial strategies of subsystems

The decision making processes within the various subsystems follow a logic and tempo of their own.

Within each subsystem specific restrictions with regard to information avail-

ability, constraints and process characteristics apply.

Strategic decisions are strongly influenced by unexpected major events.

The interpretative approach

This approach views organisations as paradigms. It takes issue with the logical element of Quinn's logical incrementalism in recognising that the cognitive shortcomings of individuals and groups can affect the interpretative process in a fundamental way. For example, it is often assumed that managers react to signals from their environment, but in fact what they respond to is their own perception of the signals. Behavioural research has shown that the cognitive model of the observer is a strong driver of the sensing process (Shrivastava, 1983; Barnes, 1984; Isenberg, 1991; Mintzberg, 1995). Closure, constancy, proximity and similarity tend all to drive cognition away from the simple physical model of eye, retina and brain (Noorderhaven 1995 pp. 74-94). Writers on the interpretive approach (Pfeffer, 1981; Shrivastava et al., 1983; Johnson, 1987, 1988; Johnson & Scholes, 1993) observe that managers tend to observe and extrapolate the historical perspective of their organisation as much as the pertaining environment. As Noorderhaven says (1995, p174) '*success breed simplicity: all minds are set at continuing a given successful policy*'.

From the perspective of this work the decision making is structurally defined and valued. The acceptability of deductive processes will be viewed within the organisational structure which has converged on the organisational paradigm. Irrationality will be viewed as a kind of secession from the organisation. The scope for rational choice is deemed to be more restricted in the interpretive model since the organisation is subject to what is known as strategic drift, because the cognitive models of the managers are unable to change as fast as the environment which they are ostensibly tracking. The response to this failure is often catastrophic, leading to staff change rather than learning by individual managers.

Strategic process - summary and relevance to present work

The examination of the strategic process above tells us much about the nature of the decision making which this work aims, ultimately, to support. First, the strategic process is a function of the organisation. The definitions of the objective are arrived at differently in different models of organisation and the interpretation of rationality is different from type to type. For example, in the strategic planning model, irrationality would be viewed as a failure of information or expression of goals, or possibly as a failure of the deductive analytic process. In the garbage-can model no one may even notice. Irrationality would be viewed as the normal disjunction of coincidence as, contrary to the benevolent view of the model, means and ends happen to be in conflict and are therefore ignored. In the logical incrementalist model irrationality is not devalued in the sense that it is expected that different subcultures will have different views of the objectives of strategy (if any such exists at the holistic level) and the means for obtaining and implementing it. Lastly, in the interpretive model, irrationality evinces itself as a gradual cancer of drift as cognitive models become more and more at variance with reality and the extrapolation of the history of the organisation becomes more and more at variance with a differently developing reality.

Second, the valuation of the strategic process depends on the level of application of the definition of rationality in the model of the organisation. It is dependent, in other words, on the value-context. Some models absorb irrationality at one level as part of the next layer of understanding. We shall see this process at work again in the section on rationality in games. We can, therefore, have an accommodating organisational theory such as the logical incrementalist model which can absorb apparently irrational behaviour by viewing it as part of a sub-process - the adoption of an incorrect goal is a necessary part of the process of strategic development. The mismatch between the local irrationality of parts of an organisation is viewed as a necessary precursor to strategy generation for the whole.

Third, definitions and views of the strategic process can be observed reified in the organisations directly. Particularly in the interpretive and synoptic models, the organisational topology is itself the definition of the process. Strategy and organisation cannot be distin-

guished. Organisations accept what they do according to their set norms as what is appropriate - what we do correctly is what is rational, and we organise accordingly.

Fourth, the appropriateness of the process depends in all cases on an adequate observation of the outside world. The different models view the adequacy of that sensing in different ways, but they all have in common that what is not sensed 'correctly' (i.e. according to what the collective cognitive model of the outside world is in that particular organisation), then it is not the basis for appropriate strategic decision making. Rationality is a function of the distributed cognitive model of the organisation and requires that model to be used.

Fifth, we observe from the work of Mintzberg (1989 pp. 342-348) Isenberg (1991) and Handy (1989) that there is an increasing need for the recognition of the power of intuitive processes in the exercise of thinking in business. It is tempting to follow the psychological arguments of rejecting these processes as inappropriate, but they are quite legitimately included if they produce results which satisfy, and can be shown to satisfy the needs of the organisation.

Strategic rationality

Scope, aims and justification

Concepts of rationality and irrationality pervade the literature and practice of strategy. They emerge from discussions of behaviour and implementation, from philosophical and ideological foundations and are everywhere to be found in the modern literature of management science. Without an appreciation of the implications of rationality/irrationality there is little justification for any predictive model of behaviour; if we cannot adjudge rationality, we cannot predict behaviour, since the prediction of behaviour implies rationality on the part of the observed system. On the other hand, much of the theory of behavioural science and social science tends to take a wider definition of rationality than the traditional rationalist, and particularly the positivist schools, admit. This section seeks to reconcile the apparent need for rationality and rational behaviour as stable foundations for decision making with the contrasting need to recognise and absorb the irrational behaviour and perspectives of the instigators, pursuers and objects of strategic thought.

Rationality or rational behaviour is a highly valued quality in human terms. We value the predictability of a person whose behaviour appears governed by a predictable connection between what we see as the facts through logic to the consequences. We find it difficult to deal with the insane, the highly artistic, the immature, the dreamer and the anarchist precisely because of the quality which, at least partly, defines those subsets of the human race. 'I can't do business with him,' we say, 'he's totally irrational.' Irrationality is the weak cousin of insanity as an indicator that the subject is unpredictable and difficult, not to be trusted, odd, a misfit. In one sense at least rationality defines not only the *sapiens* part of our biological designator, but also our qualifications for membership of one of the set of social species. Rationality defines us in our mentality and behaviour, both individually and collectively, and is at the same time both an intellectual and a social construct.

So it is with companies. We find it difficult to do business with bodies which do not share our view of what constitutes predictable, rational behaviour. Sometimes we find, when

engaged in negotiation with companies from other cultures, that the value judgements which they place on, for example, trust and integrity, are at variance with our own. We find their behaviour strange, their speech-acts opaque, their signals weak and confusing, and we then accuse them of behaving irrationally, often confusing an accusation of illogicality with an actual offence of social dissimilarity.

This view of the irrationality of others can often lead to weakness in negotiation on our part. We dismiss the rejection of short term monetary motivation on the part of businessmen from a Moslem cultural background as naïveté, failing to recognise the importance in our own culture of trust and integrity and ignoring the benefits to be gained in the long run or on a group (rather than on an individual) basis. We call irrational the rejection of a business opportunity by a Moslem businessman who has been cheated on a previous occasion; he does not behave as we do; he is irrational. Defined by his own cultural parameters, of course, he is right. Most of the time in everyday life being rational is a socially acceptable behaviour, and indeed defines that acceptability, and yet on occasions irrationality is valued and encouraged, for example in artistic thinking and in play. There is an essential dichotomy between the unifying desire for rational and hence predictable behaviour (and by implication thought) and the observation that irrational behaviour can sometimes lead to business success or creative advance.

Huge quantities of writing in the literature of management science alone have been devoted to the pursuit of the rational. The quality of decisions is largely viewed as isomorphic to the rationality of the process of decision making. In the 1970s MBA was held to stand for *management by analysis*, and the joke is not entirely without foundation; management was viewed primarily as a problem to which an answer could be found. Today this view has been softened. The societal implications of strategic thought are now recognised more, and 'right brain' or intuitive thinking together with expanded definitions of rationality have gained a place in strategic thought, but we are still, to quote Immanuel Kant (1781), '*prisoners of rationality*', valuing, almost above success, the quality of rational thought in our decision making.

This acceptance of rationality as an *a priori* requirement of strategic thought is not sufficient. If we could see no advantages in behaving or thinking irrationally there would be no justification in considering the need or demands of rationality. We can see, however, such situations around us frequently. The negotiator who behaves deliberately irrationally upsets the assumption of his opponent. The games player who plays in a considered random way will almost always gain an advantage over one who plays identically on all occasions. The insane are treated more advantageously with regard to their contribution to economic society than are their able counterparts. Moreover, there are frequent occasions when irrational thought processes are deemed creative and worthy. The poet Coleridge, for example, is a well known example of a creative individual who deliberately used rationality-suppressing drugs to engage his creative process, and at a less agricultural and self-immolating level, we frequently use the effect of the subconscious mind's background working to solve a knotty problem. The mathematician JE Littlewood (Bollobas 1953 - p.192) describes the process clearly, *'Incubation is the work of the subconscious during the waiting time, which may be several years. Illumination, which can happen in a fraction of a second, is the emergence of the creative idea into the conscious. This almost always occurs when the mind is in a state of relaxation, and engaged lightly with ordinary matters.'*

We see, then, that in at least some circumstances there can be positive advantages in acting or at least thinking irrationally, and this is itself justification for addressing the requirements of strategic thought in this respect, particularly as such an examination may yield characteristics of a strategic decision support scheme which may be either desirable or undesirable, but should at least be noted.

The scope of this section ranges from a survey of the philosophy of rationality, dealt with broadly as a background to the remainder, through the approaches taken to rationality in management science and those aspects of behavioural science which are relevant to strategic thinking. The distinctive and restricted approach to rationality taken by economics, and particularly that subset of economic thinking known as social and economic game

theory is discussed, as is the literature on critical systems thinking, which is largely redefining the meaning of rationality through the application of the philosophy of the German philosopher, Jürgens Habermas. This fourfold survey of the literature is followed by a discussion of the limits of rationality in the context of strategic thought, which will inevitably cover the value of rationality and its normative content in particular. Lastly, some conclusions are drawn which link the present literature with some desirable characteristics of strategic decision support methodology. These conclusions are subsequently linked with material in the next part to provide a symptomatic specification for a strategic decision support methodology, declared at the end of this section.

The objective of this section, then, is to clarify the position of rationality in strategic thought, and in business conflict analysis in particular. Its aims are the following

- a) to survey critically the literature of rationality in this context
- b) to identify the contribution to be expected of rationality and irrationality to the strategic process
- c) to identify the constraints induced by this contribution to the design of a strategic decision support methodology.

The Philosophical Heritage

Rationalism and empiricism - a brief developmental perspective

Rationalism in the context of the history of philosophy is a concept whose meaning varies greatly from context to context. In essence, philosophers who are deemed to be rationalist are understood to give greater weight to the products of logical, syllogistic thought than to some other posited source of knowledge, for example, faith or belief or tradition, or experience. It is an epithet which is more often applied to other philosophers than to themselves, and carries a somewhat pejorative odour.

Modern philosophy is deemed to begin with a rationalist rejection of that Aristotelian mode of argument which places the axiomatically based approaches of mathematics above all other methods of argument. This alternative argument offers a connection between axiomatic or self-evident truths and the products of algorithmic thought. Thereby our base of knowledge is self-derived, self-consistent and independent of any observation of the suspect real world by virtue of the tubelike nature of the argument from axioms to conclusions. Experience is essentially irrelevant, and in any case cannot provide the necessary degree of certainty. From our lofty viewpoint of late twentieth century post-modernism this seems rather quaint, but it must be remembered that three of the greatest philosophers espoused rationalism, or at least from the belvedere of hindsight are seen as espousing it ; these three are Descartes, Spinoza and Leibniz, against whom were ranged, in an empiricist school of retreat to practical exposure to the real world, the philosophies of Locke, Berkeley and Hume. Between these two schools, of rationalism on the one hand, and modern radical scepticism on the other, lies a gulf bridged only in the latter half of the twentieth century.

Descartes

Descartes shows us the very essence of rationalism when he wrote (Descartes, 1637) of his liking for '*those long chains composed of very simple and easy reasoning*' which he observed being used by geometers in their proofs. He drew the conclusion that all that we

had to do to expand our store of soundly based knowledge was to reject those axioms which we found unsatisfactory, and base our thinking on a set of syllogisms which would lead us inexorably to newly discovered and verifiable knowledge.

Spinoza

Spinoza (1677) is often viewed as an exemplar of the geometric manner of writing. His great work commences with an axiomatic declaration of the basis for his study of the rules of behaviour. In conversation with Oldenburg, however (Curley, 1986), Spinoza's reply to a challenge to the self-evident nature of the axioms was that he cared little whether they were self-evident or not so long as they were accepted. He later began to treat these axioms as if they were merely propositions. Spinoza proposes to his readers that if the argument is found difficult they should deal with the argument as a whole rather than accept proof only step by inexorable step, a distinct weakening of his rationalist position.

Leibniz

Leibniz, often hailed as the rationalist *par excellence*, maintained that every true proposition is either trivially true (an identity) or reducible to an identity by step by step analysis. Hence every truth is reducible to an axiom. On the other hand even Leibniz advocated public laboratories to perform experiments. When Locke offered the pessimistic observation that scientific truth could never be obtained, Leibniz replied that '*considerable progress will eventually be made ... because the great number of experiments which are within our reach can supply us with more than sufficient data.*' (Leibniz, 1765). Once again, these are not examples of the strict rationalist sentiments which are often attributed to this group of three. Leibniz, in fact, was of the opinion that only God could be certain of the priors, and held that the use of the *a priori* method by man was '*not entirely impossible*' (Leibniz, 1857) so long as he does not attempt to descend to the particular. Leibniz distinguishes between the truths of reason which constitute, for example, a mathematical truth and '*truths of fact*', a distinction which we will have reason to note in later sections.

Kant

These three then constitute the main trunk of what is known as the traditional rationalist view of epistemology, but in order to gain an adequate understanding of what rationalism, and by inference rationality, means in late twentieth century usage, it is necessary to make at least superficial study of the work of Immanuel Kant (1724-1804), regarded by many as the greatest of modern philosophers.

Kant's rationalism extended from a belief that synthetic judgements were possible *a priori* to a belief that certain concepts exist which coincide with properties of objects in existence without these concepts being founded upon their existence in reality (Kemp Smith, 1964). These are Kant's categories, of which the best known are substance and cause. Kant leaps the obvious question of how a concept applied to an object can exist without being derived from it, by appeal to transcendental deduction of categories. He argues that all representations are mutually supported by the observer perceiving them at the same time. They are co-apprehended in one consciousness. He then argues that they have such a unity only because they are synthesised according to rules encapsulated in the objects.

It is important to understand that the single most relevant conclusion of Kant's Critique of Pure Reason is a surprising reversal of the trend up to this point. In his critique of the *a priori* concept, Kant comes to the conclusion that only sense-derived material can be used to determine the categories, so that our *a priori* information is in fact limited to the experienced world. '*The source of a priori knowledge is not experience, but its only legitimate subject matter is objects of possible experience*' - such is Kant's compromise between rationalism and empiricism (van Cleve, 1993). It is this, perhaps surprising, terminus which is the starting point for the rationalist imperative of the late twentieth century, and which at the same time provides the basis for its own replacement by a post-Kantian dialectic whose operation we shall see below.

Quine and radical reductionism

Willard Quine (1908-), who has had a major effect on the development of epistemology in

this century, and in particular on understanding the place of empiricism in that structure, represents the next major step in the foundations of rationalism. Although an American, his greatest influence was during the 1930s when he visited Vienna, collaborating extensively with Rudolf Carnap, with whom he gradually came to share a commitment to the role of philosophy as part of science. In this respect, then, he represents the modern terminus of a line of thinkers rejecting the rationalist tradition which has its beginnings well before Descartes, Leibniz and Kant. Quine's collection of papers, *From a Logical Point of View* (1953) have had a great influence on modern understanding of knowledge, as, from a slightly different perspective, has his book *Word and Object* (1960).

Quine's distinction in the first work between analytic and synthetic knowledge echoes that of Kant, but his reductionism, which holds that '*every meaningful statement is held to be translatable into a statement... about immediate experience*' (Quine, 1953) represents a complete commitment to the empiricist ideal. Quine holds that the distinction between analytical (self derived) truths and synthetic (externally argued) truths can only be meaningful if radical reductionism is valid. In the study of management science this assertion may seem distant from the practical problems of business conflict, but in fact the validity of data and information on which our strategic decisions are based are determined in no small measure by the approach which we take to the nature of knowledge and the methods which we use to collect and create it from the raw material of our collective consciousness in the firm. Quine's approach, too, is highly relevant to the knowledge gathering and use of the strategic process, since it presents a signpost to the sources of knowledge. We need to understand to what extent we can operate upon our underlying concepts and internalised analysis in the firm to produce the organised information we refer to as knowledge, and to what extent we need to refer to experience. Now the ubiquitous positivist tradition would hold that reference to empirical data is the only truth, but we must take a more sophisticated approach, arguing that the retreat to measurement brings with it not just the advantages of having our feet well grounded in the plough-field of reality, but also the clods of uncertainty and error which come with that bucolic position. As Christopher

Hookway observes (Dancy & Sosa, 1993, p. 409), '*analytic truths, linking other statements to ones about immediate experience, determine how we should revise our beliefs in the face of surprising observations*'. It is this very ability to deal with the surprising that determines our ability as strategists.

Relativism

One should not imagine that it is only the battle between empiricism and rationalism which concerns twentieth century epistemology. The relativist school of thought, extending right back beyond Plato, is still a relevant doctrine of knowledge, particularly in the context of social science with its moving platform of observations and context.

Relativism espouses the nature of knowledge as being essentially a function of the state of the observer, particularly as regards time and space, culture and conceptual paradigm. It makes no sense to claim knowledge that is not a function of the state of the observer. The most savage attacks on the doctrine claim that it cannot be valid by virtue that it cannot hold of itself, i.e. it is self-referentially invalid, since if it were true it would not be possible to claim its validity except as a special case. It can be defended only by giving itself up. (Siegel, 1987). Additionally, the concept that something is 'true for me' or 'true for my company' is more a statement about what the individual or the company believes in than what is true 'out there' in the world to be observed. It will be apparent that the adherence or otherwise to a relativist view of knowledge has fundamental effects on the model of the competitive world in which strategy is planned and executed, and that the decision support methods for it are consequently highly conditioned. The mathematical work of Bacharach (1993) reviewed in a later section draws on a highly relativistic position to attack the problem of Variable Universe Games, where each player may have a different view of the universe as well as of the more conventional individualistic payoff functions.

Relativism still has many adherents, however, not least because of the unpalatability of the consequences of its rejection, since that rejection would induce a need for a theory of

certainty which is not available to philosophy except in very limited senses. The language- and sociology-based developments of Wittgenstein and of the so-called 'strong programme' of attempting to underwrite the whole basis of socially understood truth, while attractive from a management science basis as a foundation for knowledge is unavailable, not just because of its unproven nature, but because of the very contentiousness surrounding its feasibility. The most satisfactory lead would appear to come from Rorty, whose doctrine of contemporary neo-pragmatism (Rorty, 1979, 1982) offers an empirically-based doctrine sensitive to the social context in which knowledge is gained and used. This offers some hope to management science as a basis for extending our tendrils of knowledge into different structures of knowing.

Naturalism - science and social science

Lastly, before turning our attention to rationality itself, we examine the theories surrounding the applicability of the methods of natural science to the social sciences, the doctrine of naturalism. There are three reasons why naturalism may not be sustainable or even necessary.

First, the social sciences and, within them, the study of strategy as (at least in part) a social process are reflexive, in the sense that they are part of the social system which they study. So in management science do we observe that the process of managing information is the subject and object of the process itself. Unlike the natural sciences, generating theories about management is part of management itself. The problem is slightly worse, perhaps, in the behavioural sciences where the observers are deemed to be dependent upon the subjects themselves for their views of the object of study, but the distinction is a fine one. In management science we, too, are unsure who are the warders and who the inmates.

Second, social phenomena are highly complex, and, moreover are not readily amenable to the kind of controlled observations common (indeed required) in the

natural sciences. Admittedly the recent extensive work on the complex nature of physical and biological systems known as complexity theory indicates that some previously well-understood physical systems have a capacity for emergent behaviour at least as complex as social systems, but the essence of the difficulty here is that social systems do not have the capacity of being experimented upon without involving the observer or experimenter in the social system. One cannot carry out an experiment on the strategy team of a major public company without changing its view of itself, its cognitive models or its patterns of behaviour, or at least, not without making changes of such nicety that they are unrecorded.

Third is the problem of the **contestability** of many of the doctrines and theories of social science, by which is meant that they contain what amount to value judgements because, in the view of Gallie (1955) they are evaluative rather than descriptive and because of the complexity of the process of observation, which requires that many judgements be made about the admissibility of the observations themselves.

Habermas and Critical Theory

These difficulties, striking at the heart of rationalism as applied to the social sciences, therefore indicate the need for a particular and specific epistemology for the social sciences, and, by inclusion, for management science. The contribution of Habermas (1971, 1979, 1981, 1990), the successor to Marx in developing a critical theory of social structure, is quoted extensively in the management science literature (Ulrich, 1983, 1987a, 1987b, 1988; Oliga, 1988, 1990; Flood & Jackson, 1991; Flood, 1991, 1990; Jackson, 1991a, 1991b, 1991c; Flood & Oliga, 1991; Feunmayor, 1991; Schechter, 1991). We discuss his relevance to systems thinking in a later section, but we observe here that his view is that if the social sciences are engaged in essentially technical activity, they should be either practical or critical. Practical here means aiming at understanding as distinct from the critical orientation of interpretation or liberation. Habermas among others sug-

gests that we should not aim at *'the development of abstract theories directed at the understanding of the fine-grained predictions of concrete social phenomena'* (d'Agostino, 1993), but rather at understanding or interpretation at a higher structural level. The distinction is made easier to understand by an observation made by writers (Gibbons, 1987) between 'thin and thick' descriptions of phenomena. A thin description is generally understood to be one detached from the participants, behaviourist in approach and content, as contrasted with the thick description using their vocabulary and therefore using their concepts. The thick description, therefore, imbues the observers with the understanding of the participants and does not separate the two in that respect. The thick descriptions are claimed to be free of the three difficulties cited above, in that the descriptions are voiced by the participants. Other writers, however, feel some difficulty with the distinction, because of the obvious problems surrounding the independence of the observer.

The concept of interpretation is central to the specific epistemology of the social sciences. On the one hand we see a structure based on the recovery of concepts from the vague world of reality, the lifeworld of Schutz and subsequently of Luckmann and of Habermas (Schutz, 1962; Schutz and Luckmann, 1963; Habermas, 1981), and on the other a structure based on suspicion of the motives and self-delusive capacities of the participants. The great difficulty, summed up in the Principle of Charity (Davidson, 1983), is that unless we can relate to the beliefs and understandings of the subjects of our research we cannot take any view of the empirical data. If we are not to have a broad agreement with their beliefs we will find their behaviour opaque, mysterious and forbidding. The relativist opposition of Quine (1960) in pointing out the imperative of viewing all truth from the point of view of the observer is a related position. Here, in the social science epistemological debate we see an even more difficult problem in the Principle of Charity. Essentially the observer is part of the observed system. Relativism, with all its problems, appears inescapable.

Habermas (1981), however, offers some solace through the concept of communicative action which aims at testing, during the observations, the validity of the claims implicit in the actions of the participants. Claims which pass our collective tests are admitted as evi-

dence. The message here for management science is that checks on the basis for consensual approaches to epistemic valuations are essential, a point which has not escaped the practitioners, but which we must continue not to ignore in practice and in particular in the design of decision support systems.

Logical positivism and undecidable propositions

It would be remiss to leave any review of the rationalist and anti-rationalist traditions of western philosophy without reference to the logical positivist school, derived from the logical empiricism of the Vienna school of the 1920s and 1930s, which has so influenced scientific – and therefore empiricist – thinking since then. It is positivist in its assertion that science is the only form of knowledge, and it is logical in its dependence on logic, and, in particular mathematics, as the only basis for argument. The essence of the argument is that epistemic objects outwith the reach of science are unknowable and therefore to discuss them is meaningless. Logical positivism relied and continues to rely on the essential belief that unless something is formally decidable in the language of mathematics, and meta-mathematical logic, then it is inadmissible.

It therefore caused some shaking of the rafters when the implications of the work of Kurt Gödel (1931) became clear. Gödel's seminal work challenged the very heart of the logical positivist body, in that he discovered, by a process of using mathematical structures to examine the logic of mathematics itself, that in any sufficiently rich structure there were propositions which, although true could not be formally proven. The effect on the logical positivist establishment was slow to occur, but fundamental. Not only had the structure fallen, it had been pushed over from within by mathematics itself. The argument, however is not over; it has merely moved to another part of the forest where we can hear the noise of blows being struck between Lucas (1961), Anderson (1964) and Good (1967), engaged in a fight over the relevance over Gödel's theorem to the processes of the human mind.

The zoo of rationality

Types of rationality

In philosophical terms rationality can be roughly described as the use of legitimate reason. There are nine commonly applied descriptions (Dancy and Sosa, 1993, pp 415 - 49).

conformity with deductive logic

The most obvious use of the term rational is in indicating that the correct rules of deduction have been applied.

correct calculation

There is a correctness inherent in the correct application of the rules of mathematical calculation.

definition or meaning

Certain conclusions can be drawn directly from the definitions of words

appropriate extension

Some arguments are justifiably extensible from an empirical to a general theory. For example adequate controlled examination of the real world would be regarded as a good basis for the testing of a general theory.

correct assessments of probability

The correct application of self-consistent arguments to probabilities is a particular kind of rationality widely recognised and highly relevant to strategic conflict questions.

factual generalisation

It would be a rational deduction to assume that if it has been raining the grass will be wet. Generally speaking gardens do not have roofs on them, and it would be irrational to assume otherwise. Conversely, however it would not be rational necessarily to assume that because the grass is wet it has been raining. The hose has been in action.

personal advantage

In economic theory in particular it is assumed that an individual will act according to a rule which maximises his utility.

morality - ends and means

Connected with the previous category of rationality is the supposed rationality in considering ends rather than means.

meta-linguistics

The understanding that communication takes place between humans who have at least some common understanding over and above what is strictly being said provides the basis for a rationality which is best described as meta-linguistic. For example, if in reply to the question, 'How was the play?' one received the answer, 'The scenery was pretty good' one could draw rationally the conclusion that the leading lady wasn't.

The type of rationality, specifically, which lies at the heart of strategic decision-making, concerning economic behaviour is contentious. Sen (1982) has pointed out the danger of assuming that dishonest behaviour is irrational, by considering the actions of a criminal accountant. From an economic point of view such embezzlement would be viewed as irrational, but from the accountant's viewpoint, entirely the reverse, particularly if he judges the probability of being caught as vanishingly small.

Lastly, we should consider the philosophical background to the issue of intuition compared with deduction, and hence with rationality. Intuition is knowing a conclusion directly, from the thing itself, without deduction, immediately and without mediation. In this respect it is distinct from knowledge by deduction, whereby the knowledge occurs by the application of a chain of reasoning. Generally speaking intuition has been viewed as highly suspect by philosophers. One can cite, for example, Frege (1974) as the philosopher who has most enthusiastically tried to winnow out the chaff of impure intuition from the pure grain of logic. Listen to Frege (1967). *'To prevent anything intuitive from penetrating here unnoticed, I had to bend every effort to keep the chain of inferences free from gaps'*.

Locke on the other hand was, like Descartes, a strong supporter of intuition, arguing that a syllogism is actually redundant when the mind can make the leaps of correct argument

without its encumbering weight. There is, indeed, a practical difficulty here, too, in rejecting intuition: as Locke is reported to have said (Stough, 1993) '*Intuitive proofs are shorter*'. It is difficult to conceive of any process of reasoning in practice which did not rely on intuitive leaps to a conclusion which is then tested retrospectively by applying purely deductive (or inductive) chains of reasoning. We shall see later the effect of this intuitive/ deductive interplay in the design of the strategic conflict resolution network method.

Organizational Limits to Rationality

Rationality in Organisations

The purpose of this section is to discuss the concept of rationality within decision making in large organisations, since it makes little sense to consider a strategic decision making process without at least a vestigial organisation to apply its implementation. It is clear from even a superficial examination of the behaviour of individuals that their behaviour is changed by being part of a wider structure, and since all human beings (with the possible and temporary exception of Robinson Crusoe) are a part of wider structures we can confidently assert that the separated individual is, like the single magnetic pole, a convenient abstraction. Before going on to examine the main models of decision making in organisations it should be made clear that the word 'organisation' here is essentially that of the industrial organisation, but without specific definition. Close-knit and geographically-coherent firms; distributed and loosely-organised companies are all admitted. Equally, the exact limits to what is meant by organisations in social terms are deliberately not narrowly defined; an organisation could be included which extends even beyond the limits of the commercial hegemony of the individual company and into a wider and often more loosely defined social structure. Burns (1971b), for example, describes the way in which career paths within industries form social structures (loosely organisations) around and beyond the formal structure of the firm, in his example, of the BBC.

The central concepts here, in analyses such as that of Weeks and Whimster (1985), concern the decision-making context of individuals, in terms of the ways in which organisa-

tion and structure set the contexts for rationality. The goals and objectives of individuals are at least attenuated or modified by the organisations in which they sit. The means and ways are, in the main part, set by the organisation. At its most fundamental level it is the organisation which requires that rationality be engaged in requiring that a decision should be made. Generally speaking, the requirement upon the individual is apparently to act in a strict economic optimising fashion. 'Organisation-man' is the epitome, in terms of his set objectives, of the *homo economicus* so beloved of the economic community, a being so limited in his understanding of the world around him, so uncaring of the effects on his fellow man that he is limited to maximising his profit in the form of a transferable quantity known as utility and usually rendered in translation as profit.

In the organisation the individual receives the goal, the information and the environment in which the decision is to be provided in return to the surrounding organisation.

Conventional descriptions of organisational rationality (Weeks & Whimster, 1985) distinguish between programmed decisions and non-programmed decisions; the distinction is in the degree of discretion allowed. It is primarily with the latter that we are concerned.

Rationality within the organisation has a retrospective sense different from its generally synthetic contribution within the general philosophical framework. Often it is viewed not as a path to a decision but as justification of a decision. Rationality is linked inextricably to the process of decision making. Pfeffer (1978) lays out the position clearly. '*[It] is generally construed to mean choosing that course of action which will maximise the chooser's expected utility. The concept of utility recognises that outcomes may have different values to different persons, and the concept of expectation recognises that decisions may be made under conditions of uncertainty.*' It will be seen that this forms a wholly appropriate basis for the judgement of utility-based reasoning needed in this present work.

Bounded Rationality

One of the clearest views of the role of rationality and decision making in organisations comes from HA Simon (1965) who distinguishes between 'economic man', taking his

maximising decisions in an optimal fashion according to his utility function, and 'administrative man', operating within an institutional organisation. Economic man operates essentially in what Simon calls an 'objectively rational' framework, where the originator of the decision is required to quantify all the inputs and outputs of the decision process, provide a clear definition of the utility to be maximised and the associated costs and penalties. He has clear preferences, outcomes are scaled and the goals and the means are compatible. Little or no account is taken of how the decisions are arrived at or how they are implemented. It is man as bureaucratic entity.

Administrative man, on the other hand, is constructed with the view that any decision making process is not to be understood in isolation from the environment in which it taking place. The decision maker is part of the organisation. He will certainly also be part of the decision and its implementation and will usually be, at least in part, the subject of the decision.

Simon describes this type of rationality as subjective or bounded rationality '*people act intentionally rational, but only limited so*' (Simon, 1957). In these circumstances the goal becomes not optimality but adequacy, and we see the rise of **satisficing** (March & Simon, 1993), where it becomes important to find a satisfactory alternative to optimality. This is in stark contrast to the recognised behaviour of economic man. Decision makers are no longer assumed to have a measured ordering of outcomes, or even an ordinality. They simply adopt a sequential choosing procedure which leads them either to the end of the list of perceived alternatives or to the first adequate solution. The process stops as soon as the level of aspiration is found (Simon 1955).

Contingency theory (Perrow, 1974) extends this view. Perrow holds that we must view a range of contingent factors which affect the organisation at particular moments. No absolute model of the decision can be constructed, since this will change from time to time and from situation to situation. The connection with the relativist school of philosophy above is clear. We shall see later the important influence of Habermas and the post-Marxist phi-

losophers on our concepts of behaviour in social systems, which affects not only the descriptive view of man in organisation as rational being, here, but also the systemic, potentially normative decision and delivery systems of late- and post-modernist critical systems thinking.

Noorderhaven (1995) gives four types of rationality in summarising the literature, namely:-

Substantive Rationality

Here the decision maker takes the alternative that is objectively best, having concern only for the choice rank ordering of the decision maker. It is assumed that information is complete and deductive errors are absent.

Instrumental Rationality

The right means are chosen in relation to the end, given the decision maker's set of beliefs. No logical errors are assumed, but the decision maker's belief space does not necessarily correspond with reality.

Cognitive Rationality

All the information available on the environment is deemed to be available, as a special case of instrumental rationality.

Procedural Rationality

This simply requires that, in the light of the information available, a reasonable decision-making procedure is followed.

Social Science Critiques

Three types of critique can be applied to the concept of economic versus administrative man: a social process critique, a structural power technique and a communicative rationality technique, and each will lead us to an improved understanding of the limits of man's rationality in the organisation.

Social Process Critique

The social process critique takes as its starting point the assertion that individuals within organisations belong to groups, and are therefore influenced by the environment set by those groups in the widest possible sense. Let us not be confused by the appearance of organisation charts. These do not define the organisation. Organisations develop subcultures and sub-organisations with rules and objectives that may align themselves with that of the overt organisation only in part and only from time to time. As Weeks and Whimster (1985) observe, '*Under these conditions the identification of unambiguous organisational goals becomes a hopeless task*'.

Mintzberg's bleak view of the large US organisation as a machine bureaucracy (Mintzberg, 1989, pp 334-373) supports the social process critique. He refers specifically to the way in which an aggregated rationality descends over an organisation, which squeezes the life out of individual rationality. This is a somewhat extreme view of the lack of resilience of the members of an organisation, and one which is at variance with the parallel rationality view which is favoured here, but it is a valid view in at least some organisations. Mintzberg also draws our attention to the irrationality of attempting to achieve rationality in an organisation of a machine bureaucratic kind.

Structural Power Critique

This concept of the power holders within an organisation observing, and, indeed limiting the rationality of the members of an organisation is the essence of the structural power critique of rationality. The thesis of proponents of this view, such as Durkheim (1938), is that the goals which organisations apparently set themselves to achieve are in fact set, or at least highly conditioned by a wider social structure. A good example of this is the Marxist view of the organisation, which does not take the limited view that the profit motive of firms is sufficient explanation for their behaviour. Firms are viewed as elements within a wider social structure of economic, educational and social power within which they are buffeted and thrown. The aim of management is to control what is called the 'effort bar-

gain' (Baldamus 1961) by which the costs of production are kept low and the output high. Clearly such a bargain could only be successfully modelled in a wide social framework which would include political power, overall economic power and the educational empowerment loaned to successive generations of production captives by an overarching power structure.

There are less extreme views, however, even within the Marxist ideal. In contrast with the account above, which is a paraphrase of Braverman (1974), a view has emerged in the 1980s (Herman, 1982) which, accepting that the power of production will always prevail, recognises that management control is nevertheless exercised through a hegemony, whereby the relations of consent and contract between workers and management is the basis for a distributed replacement of the iron-bound harness and bit of the essential Marxist concept.

Shrivastava (1983) indicates that the whole process of orthodox strategic management actually constitutes a self-serving self-perpetuating power group part of a community of interest which transcends the firm. He draws attention to the microcosm within the firm of the power-establishment surrounding the firm. Porter (1980), in his influential analysis of company strategy leading to his later work (Porter, 1985) relegates the consideration of company profit motives to a footnote, and almost entirely ignores the surrounding pressures on the firm of regulatory bodies, government and society.

Rationality then, is once again seen to be a swirl of mist, blown around by the surrounding pressures of the social context. The rationality both of individuals and groups within the organisation and of the firm as a whole is a largely unobservable and unmeasurable attribute, for how are we to measure it? If we are to observe rationality of the firm from outside it, how can we detect the extent to which the deductive process is carried out, even assuming that individuals in the organisation are compliant with our own view of the ends to be achieved? If from within the organisation how can we be adequately aware of the implicit goals set by the collective of pressures outside the firm, which are uncoordinated and incoherent, and which collectively set the requirements for the behaviour of the firm

since we ourselves are part of the observed process? It is not sufficient to argue that it is the shareholders who will set the agenda, for there are powerful arguments (Freeman, 1984; Mitroff, 1983) of the importance of other stakeholders in the firm. The importance of competitors, too, as part of the wider power context has not been ignored (Garratt 1995), '*... it is not possible to form strategies for one's own firm until you [sic] have taken a view on the strategies of the competitors, potential competitors and allies*'. And having done so one must conceive of a reciprocity of capability which will imply that the competitors will have done the same analysis for your company *mutatis mutandis*, and that your strategic context is itself now changed since its context has changed. A message for the analysis of conflict is the multiple recursion of strategic views. The development of one's own strategy in turn affects the start point of competitors' strategies, which in turn affects the environment of one's own decisions and so on.

Communicative Rationality

The last critique of rationality in organisations is a powerful one, stemming as it does from the thinking of Jürgen Habermas (1929-), the influential German philosopher and sociologist and part of the Frankfurt School of Marxist social theory. Unlike conventional Marxism, the critical theory is highly self-observant, and has engaged itself in an examination of the meaning of rationality which has been enthusiastically picked up by the social science community (Ulrich, 1983, 1987, 1988; Oliga 1990; Flood & Jackson, 1991; Feunmayor, 1991; Flood, 1991, 1990; Jackson, 1991a, 1991b, 1991c; Flood & Oliga, 1991; Schechter, 1991).

Habermas is centrally concerned with rationality, and starts from a point similar to that of Weber in sociology. Both their concepts of individual rationality recognise the instrumental rationality whereby, by considering alternative means to an end, and by taking into account the means to that end, and the secondary results, the relative importance of different ends can be weighed one against the other (Weber, 1968). This is a tall order. Haber-

mas (1984) considers such action not to be social. Such myopic behaviour is in a sense sociopathic, since it does not recognise the need for the individual to form a part of the social order. Moreover, goal seeking of this parochial nature is directly antisocial since of essence it requires the individual to use others to his own ends. Habermas' communicative rationality requires the group within which the individual sits to reach a common understanding. Individuals act as parts of a group. Now this concept is not limited to the role of individuals. Groups who themselves acting under bounded or limited rationality are in social intercourse with other groups, and such are required to engage in communicative acts to establish a balance of pressures at their level of aggregation, too. Habermas effectively conceives of four types of rationality or action: **teleological or instrumental action**, where the activity is goal-driven and insensitive to the social context (analogous with administrative man), **strategic**, where the social context is recognised, but only so far as to take into account the rational behaviour of other persons, **constative or communicative**, where mutually acceptable and understood agreements are reached by members of the social group and **dramaturgical** which operates exclusively in the aesthetic sphere (Habermas, 1981, I, pp. 331-335).

This communicative action faithfully reports and accounts for the social mechanisms and processes within the group and gives full account of the social power flows within the group and outside it (in so far as the group is aware of them). A necessary consequence of this is that rationality is no longer the limited concept of Kant and Descartes; it encounters the full social processes in a way that are not (some would argue should not) be expressed in the poverty-stricken language of syllogism. In any case the application of any syllogism is a vain hope - the group will shift its ground in argument, since, being self-referentially subject to its own deductions, will include its own mutating interests in the emerging rationality. The consequences for rationality in our organisations are stark. Habermas rejects any possibility that communicative action can encompass instrumental action. If instrumental rationality is the characteristic of an organisation, communicative rationality cannot survive there.

Habermas (1981, I, pp. 8-42) gives three criteria for a new rationality:-

1. The proposition can be tested against the objective world.
2. Its content and the way in which it is said is compliant with the norms of the group
3. The speaker is held to be sincere in his or her communicative regard for the group

Habermas is attempting here to transcend the mere expediency of group compliance with action. He is concerned greatly with the ideal that the group as a whole will now hold a common view of the world and of its objectives, ways and means. Thus he seeks to establish an empirical rationality more real than the parochial definitions he sees earlier in philosophical development.

There are difficulties here, however. First, there is a problem over the extent to which communicative rationality represents a stable decision mode. The very self-identity of the group engaged may be defective. It may contain members who do not share the same or even consistent views of the aim of their activity. Habermas' world seems to contain only individuals who are amenable to argument. After all he rejects the role of power as a legitimate means of control and persuasion, and unless the majority of individuals comply with the objectives, there would seem to be practical problems in initiating movement towards a consensus. Second, time is often a limiting factor in decision making, and the consensual approach would appear on occasions to be impossible to achieve in a timely fashion. Third, the members of an important group may not be accessible or able to be communicated with. It might for example be a highly communicative-rational act to discuss issues of procurement policy with competitors, partners and customers, but only a minority of those will likely wish to participate.

Modernism and post-modernism: lessons for conflict analysis

Management science today sits on the boundary between the deeply positivist Harvard Business School 'management by analysis' observed above and the social science perspective which reflects the human organisational issues that surround the implementation and indeed the problem-framing phases of strategic response. We need to be aware of the social science perspective on these apparently hard-edged strategic issues of conflict because of the increasing awareness generated by, among others, Churchman (1979), Ackoff (1974, 1981) and Checkland (1984a, 1984b, 1989, 1990) that the dimensionality of the problems of response to the needs of a social system is higher than we thought. Prior to the soft-systems revolution of the 1960s and 1970s, we could afford to assume that the organisation has sufficient self-awareness and contact with the surrounding real world to be able concisely and accurately to express its desires in a way that could be analysed and implemented. Now, however, our view is somewhat different, and it has changed not just because of the practice of different systems theories, but because theories of system theories, too have advanced. In particular the advance of modernism away from the narrow confines of positivism has provoked a new wave of rejectionist theories, bleak and cynical in their view of knowledge and the possibility of progress, which we call post-modernism.

Modernism in today's vocabulary upholds the ideas of rationality and the advance of the human race towards an asymptotic perfection in themselves and in their social organisations. In business terms it would conceive of an organisation which was aware of its objectives and limited in its ability to achieve those objectives only to the extent that it could think its way through the stormy episodes which form the future, accommodate them and reach the desired conclusion. Modernism views the world as logical and orderly; we are limited in our knowledge of it only by our ineffectiveness as observers. Models of the real world can be constructed, tested against the environment and either accepted or modified. This essentially logical positivist approach was the dominating paradigm even of the social sciences where, however, as Vickers (1983) has observed, '*Human systems are different*'. Language is viewed as the primary and transparent vehicle for human communica-

tion, by which real meaning can be transferred from the mind of one human animal to that of another.

Post-modernism in comparison is an anarchic, self-fuzzifying set of views which tends to reject self-definition even, as energy-sapping and irrelevant. It seeks to puncture the self-important balloon of certainty inflated by modernism. It denies even that science has any access to objective truth, and rejects the progress of history and society towards any unitary end. Society and the real world are viewed as so complex that the narrow explorations of science and the poverty-stricken models it generates are doomed to fall under the weight of error, complexity and confused self-induced mutation of the universe. Language is more a barrier to communication than a channel; it is not transparent, and, moreover is the field on which an arbitrarily large number of 'language-games' are played, each speech-act being observable at any depth by successively more opaque examinations of potential but unidentifiable meaning.

All, however, is not lost, but we do have to be tolerant of newly perceived differences, to be aware of the potential parallel rationalities of different speakers and thinkers. Since there is no 'meta-theory' to explain the world (Jackson 1991c) we must learn to live with the incommensurable. Post-modernism thrives on the paradoxes inherent in this iconoclastic view of parallel realities and extreme philosophical relativism. It rejects the invalidity of '*true for me*', discussed above, by a crushing certainty that there is no certainty and that there is no other truth other than relativist truth. The image is more significant than any reality because there is no reality. It has a disturbing tendency to reject any values of seriousness and discipline, emphasising superficiality and ephemerality.

Systemic and critical modernism

Lyotard (1986) gives a view of two types of observable modernism, namely systemic modernism and critical modernism. Systemic modernism is a postwar thesis, generated in parallel with the rise of operations research and the logical positivism of physics. It views

social systems, including firms, as mechanical structures, with rules of behaviour which can be approached by successively improving models satisfactorily tested in the external world. The more work we do the better we can understand the system. The system itself is the product of an instrumental rationality which leads to a development of its history and progress towards its own defined aim. In particular, it follows its own logic to increase what is known as *performativity* or self-defined efficiency. '*Humanity is dragged in the wake of the system*' (Jackson, 1991c). Science is preferred over all other types of learning and in turn science and technology become the servants of the system itself. Research becomes limited to those activities which increase performativity. Perhaps most serious is Lyotard's (op. cit.) observation that what is implemented becomes what is correct, even to the extent of education.

Critical modernism, on the other hand, is concerned with Lyotard's '*grand narratives*', whereby society is a part of a great structure with a single collective purpose. There are two types of '*grand narratives*' which unify the activities of the system. First is the idea that there are philosophical totalizations which potentially unify all knowledge. There is a search for what the physicists call a TOE, a theory of everything, or its equivalent in other sciences. Hegel (1817), for example, develops a theory of universal history of philosophy. Second come the ideas that history is a progressive liberation process. Once again the theory is that in this, the best possible universe, there is a unifying principle of unitary progress. The philosopher whom we have been observing in the previous section, Habermas, is viewed as the archetype of critical modernism, and we have seen that his ideas are even now only beginning to become accepted in the practice of management science, as practitioners become aware of the fruitfulness of concepts which rely as much on the communicative collective sense of groups as on the ability of the systems modernist practice to develop more and more complex models. Habermas can be seen to be a central structural element of the critical modernist tradition by observing that his communicative action (or rationality) concept assumes that there is a means of communicating and that language is an adequate vehicle for the gradual unification of the perspective of interested

parties. The post-modernist would strongly deny the existence of such a medium of transfer of knowledge, and would view Habermas' perspective as naïve, since it relies on the thesis that individuals in groups are doing anything more than playing games with their utterances. Both the modernist traditions hold the assumption that there is a reality beyond the laboratory, the lifeworld of Schutz and Luckmann (Schutz, 1962; Schutz and Luckmann, 1963; Habermas, 1981, I, pp. 108, 340-343, *passim*.) which can be sensed and approached by observation and communication.

Lyotard's great contribution to this debate is the observations he makes surrounding the prostitution of system power in the furtherance of the system itself. In business terms, without the emotive language, we are dealing with the stakeholder concept (Freeman 1984). Different groups within the company have different and not necessarily complementary ends. In the analysis of the unenlightened firm using Freeman's approach we recognise in the behaviour of the board and senior executives in rejecting the wider interests of the stakeholders, the rejection of the type of ideas which Lyotard expresses. In the application of stakeholder analysis we see the operation of a wider definition of the community of interest. The application of stakeholder analysis in any form which required intercourse between the groups identified, as distinct from the merely unitary analysis from within the power group of the firm as an externally imposed analysis, would be a clear indication, albeit loosely expressed, of the communicative rationality of Habermas. The critical modernist thesis is at the heart of emergent best business practice. Lyotard, however, has commenced an examination of some of the cracks at the confident foundation of modernist theory.

The arguments of the post-modernists

To identify some of the cracks let us take the case of science. The positivist approach to science, espoused essentially by both the systemic and critical modernist schools, views science as creating models of reality convergent to that reality. It deals with essentially stable systems; if there is instability it can be modelled in a higher dimension (sometimes

literally, sometimes metaphorically) and the understanding achieved at that greater level of complexity of view will resolve the instability. Brownian motion, for example, the archetypal random process, is rationalised by the application of a model, called a random walk model, which explains enough of the attributes of the elements to allow a feeling of security that even though we cannot predict the behaviour of an individual dust speck, we have an adequate model of the aggregated behaviour of the dust specks.

Unfortunately, this is now an inadequate view of the behaviour of scientific epistemic objects. The work of Schrödinger and Heisenberg, in particular, have shown that there are physical limits to knowledge. The pre-1950s view of science as a knowledge-aggregating engine, rolling towards a more perfected view of the universe, is untenable. Such concepts as Schrödinger's representation of the existence of an object at a place as being expressible only in probabilistic terms, and Heisenberg's observation that the momentum and mass of a particle can only be jointly measured, so that there is a limit to the total knowledge which can be obtained, is equivalent to the truths expressed by the social science community about their own experimental universe, namely that observation itself causes ripples and changes in the observed system. The new physics is concerned directly with those instabilities, and seeks expressions of the behaviour of systems which are no longer particulate (in the sense of applying to particles), but which may of necessity only be expressible as emergent properties.

Next the post-modernists attack the concept, inherent in Habermas' work, that there can exist an overarching metalanguage which can provide a means of communicating between different interest and perspective groups (Habermas 1981, I, pp.95-101, 397-398, II, pp.259-261). Conformity of any sort in utterances is an embodiment of an imposed power structure, and language itself then becomes divisive rather than a catalyst for convergent behaviour. All we can hope to do is to deconstruct (Foucault 1969; Cooper and Burrell, 1989) the language in an attempt to understand not any fundamental meaning, but which pseudo meanings, embodiments of the abuse of language by the users, we can de-

tect. We can tell which lies are being perpetrated but not detect the truth. The connection between this and the conversations (speech-acts or communicative acts) of negotiation and competitive manoeuvring is clear and highly relevant for the study of strategic conflict in the required social context.

This anarchic hopeless view of post-modern knowledge-seeking, however, is not without its more hopeful aspects. There is, for example a concept of justice through the individual's ability to come from behind the shield of collective responsibility and stand unencumbered in the confused world. The knowledge that we live in a universe of alternative realities is itself a kind of rationality. It makes no sense to behave in a rational way if that implies the use of knowledge that we cannot have. The irrationality is not, however, universal. We clearly claim to know some things, even if that is that we know nothing.

Critical Systems Thinking

It will now be clear that the two modernist schools of thought (systemic and critical) have spawned a number of methodologies for the examination of systems. The analysis of two of these, namely

1. the hard systems approaches of the general engineering discipline and the associated OR and mathematical support and
2. the soft systems methodologies of Checkland and others

are covered in chapter 3 in a separate survey of their literature, treating them as specific potential sources of methodologies, methods and techniques for strategic conflict resolution. Here it is only necessary to align the two systems approaches with the relevant philosophical views and to address an emergent approach to systems which calls itself critical systems thinking and which claims to hold the ground won by Habermas and others at the boundary between modernism and post-modernism.

It is best to review briefly the approaches known as 'hard'; and 'soft' systems before addressing the critical equivalent. The approach follows Jackson (1991a).

As Checkland writes (1984a), hard systems approaches are ‘...based upon the assumption that the problem task they tackle is to select an efficient means of achieving a known and defined end’. The framing of the problem then allows a quantitative model to be created the aim of which is to include all the relevant aspects of the problem. This model is then used as a predictor whose results are then compared in logical positivist fashion with the available data in the real world. If necessary adjustments are then made to the model. It is clear that this approach is coincident with what we have described above as systemic modernism. The rationality of the model is an instrumental one. To the extent that knowledge is gained it is enclosed within the system representation. It is open to all the criticisms which have been levelled at systemic modernism by its detractors, including the structural power critique, here particularly relevant because of the ‘ownership’ of the OR function in large companies by the senior members. In Noorderhaven’s (1995) terms, the hard systems approach exhibits instrumental rationality and is the servant of a normative rational paradigm. Jackson (1991a) observes that the modernist approach can be reinterpreted with all its criticisms in a post-modernist fashion. Thus the unavailability of objectives and the frequent failure of the information sources necessary for such an approach can be viewed as evidence of a doomed search for order in an irrational and unpredictable world.

There is a particular subset of systemic modernism, exemplified by Beer (1979, 1985) and Steinbruner (1974) which adopts an essentially cybernetic approach to systems. To a degree this approach is more flexible than the main line systemic approaches, to the extent that Beer’s viable system model accommodates changes in the environment which could not have been foreseen. Requisite variety is required within the system, and this variety then has to be managed. It is quite clear that Beer’s work, by his own words is an element of the modernist approach. As Jackson points out (ibid. p 295) Beer views his own work as generating tool design rather than ‘social system design’. Beer’s model is open to the same criticisms as other systemic modernist approaches, but it is widely criticised, in particular, as being a ready-made controlling mechanism for those in power within an organisation to suppress the generation of new rationalities within the structure.

Soft systems thinking

Soft systems methodology, SSM, is concerned with ill-structured problems. The works of Checkland and others (Checkland, 1981, 1990; Ackoff, 1974, 1981; Churchman, 1979)) are well known and a full critique is delayed until chapter 4. It is considered that they represent an advanced state of systemic modernism, bordering on the critical modernist approach. Both Churchman and Ackoff claim an enlightened objective for the work, even to the extent of claiming that it is a method of pursuing the ultimate objective of society. Checkland (1984a), interestingly, sees SSM as a ‘... *formal means of achieving ‘communicative competence’*” in the unrestricted discussion which Habermas seeks. However, the examples which Checkland, in particular, cites are almost all of the system modernist type. Little is done in practice to ensure the width of conversation which the communicative rationality requires. A particular criticism is that the methodology itself contains no requirement to examine the validity of views of reality or of the validity of the objectives presented to it.

Critical Systems Thinking

During the 1980s the critical system theories of Ulrich (1983) and (Flood, 1990) attempted to embrace five characteristics in order to fill the gaps perceived in the SSM approach in particular. These five characteristics are

1. critical awareness: A particular awareness of the assumption and values entering into proposals
2. social awareness: An awareness that there are social pressures which make certain methodologies and approaches more acceptable to the existing structure than others.
3. a dedication to human emancipation.
4. complementarity in use: A commitment to the use of systems methodologies in practice
5. complementarity in development: A commitment to the development of systems techniques.

Critical systems thinking today is viewed as being on the verge of turning itself into a post-modernist approach, on the basis that Habermas and Foucault, who stand on opposite sides of the modernist/post-modernist chasm, would each view plurality of theories as acceptable. The main argument, in fact, is one surrounding the extent to which information follows the power in an organisation (or vice versa) or whether power is applied independently of knowledge since there is no accepted basis for knowledge in a post-modernist world.

It cannot be claimed that critical systems thinking has been extensively applied. The systems of systems methodologies applied by Flood and Jackson (Flood, 1990; Flood and Jackson, 1991b) in the form of TSI (total systems intervention) is one example, but the applications appear at present to be ill-directed. They do not appear to satisfy the inevitable specific demands of the recipient community for methodologies which satisfy their perceived requirement. In spite of critical modernism and post-modernist interpretations of the world there are still the payers of pipers and they still call the tune. The message for the design of methodologies of strategic conflict resolution and analysis is that a methodology must be acceptable in the culture in which it finds itself being applied.

Relevance to the present work

What is seen in the critical modernist/post-modernist dialectic is important in terms of management science. If we accept the post-modernist view (and we do not have to), we can view the failure of its type of rationality as an opportunity to advance a metarationality. Observation of the historical perspective at the beginning of this chapter will reveal successive enclosures and rejections of different types of rationality. Often when we accuse others of behaving irrationally it is because we do not understand (at the instrumental rational level) what they are assuming as their ways, means and ends. Once we understand that, their irrationality can appear logical and understandable. Such a 'helicopter view' is an example, from the point of view of the instrumental rationalist, of a metarationality being applied. From the perspective of the observer of rationality, however, it is not a

metarationality, but the straightforward application of tests of rationality in compliance with a higher dimensioned model.

In this respect the mobilisation of post-modernist views of knowability are a metarationality over and beyond that of the two modernist traditions.

This concept of metarationality will be seen to be central to the structure of the framework disclosed later in this work. The post modernist metarationality conception allows for the embedding of systemic and critical modernist structures within a self-referential overall structure. In so far as we can detect metarationality then the approach is a valid one. In so far as it fails to represent metarationality, like any other representation, it will be defective.

Jackson's (1991a) view is as follows. *'There are four issues raised by post-modernism which emerge from our discussion as having important implications for systems thinking and practice. These concern logic and order, progress, power and language. The search for logic and order and the desire to design well-structured systems seem inherent in hard and cybernetic systems thinking, and yet the feasibility of achieving these has been radically questioned by post-modernism. The pursuit of progress has been in terms of the performativity of systems ... but this is regarded as a dangerous myth by post-modernists. Power, which is central to any post-modernist account of social relations is largely ignored by hard and cybernetic methodologies and is treated simplistically even in modern versions of soft systems thinking. Finally, soft systems thinkers and critical thinkers both embrace language as the medium through which understanding, consensus and accommodation become possible.'* The design challenge for a strategic conflict management tool is to introduce these metarationalities, and, specifically, the representation of power into an approach which will be acceptable to practitioners.

Limits to individual rationality

As we have already observed, the primary context for rationality in strategic thought is that of the organisation. The organisation instigates decision making and conflict resolution through its executive structure, provides the definition of the required end result through its observation of the outside environment together with its inherent knowledge of its own objectives, and, lastly, provides the ways and means for its implementation through its provision of resources. Hence, in all major respects, it is the organisation which conditions most strongly the decision context. Organisations, however, are composed of individuals, and we should make certain observations about the limits of rationality for the individual, particularly so in the case of rationality in the context of strategic conflict analysis, since it is often a small group of individuals who govern the critical events.

Since the decision making of the individual as part of the organisational structure is dependent upon the information available, we need to examine the extent to which the individual is in a position to have access to the environment, to the objective and to the ways and means of strategy, not just in terms of making good strategic decisions, but also for implementing them. Next we need to consider the limits of individuals' cognitive abilities, since access to information does not guarantee an efficient evolution of data into knowledge. Third, the essence of rationality, as we have seen both in our historical development perspective and in our examination of the organisational issues, is deduction, and we shall examine the ways in which individual deductive capability can fail. Fourth, we observe that there are occasions when rationality is transcended by other modes of behaviour, some of them societal and some of them inherent in the individual. Fifth, we look at those circumstances where apparently irrational behaviour is, in fact, the result of limitations being placed on the individual by the organisation failing, deliberately or involuntarily, to provide the wherewithal for the decision to be effectively made or implemented.

Information failures

Within the organisation the individual is largely dependent upon information being pushed to him, rather than being able to pull information in by pro-active means. Peter Drucker (1992) argues for the distribution of mandate, inherency of change and above all for equality of knowledge within the organisation, but points out that the prerequisite for such efficient decision making structures must be what he calls 'a freedom of organisations from policy'. By this he means that the organisation must be free to react to whatever it senses on the basis of its collective cognition, rather than having to comply with a prearranged policy which is made at a time when the policy-maker cannot have been aware of a changed situation. This is, however, a doctrine of imperfection, since, additionally, any organisation needs to be aware of that overriding vision which stems from its most senior executives (Shrivastava, 1983). If the Drucker approach were to be followed, one would develop an extreme case of an incremental organisation with little semblance of structure or declared purpose.

Organisations are not perfect at accessing information either on internal or external matters. To the extent, for example, that information systems departments continue to present data and information to the executives they, in turn, will suffer from a paucity of the knowledge which is indispensable for action. Weick (1985) and Huff (1985) illustrate the complexities with which organisations have to cope in presenting knowledge to their constituent elements, drawing on the mental map images to show the disparities which can exist within organisations. See also McCaskey (1989). If the organisation has no coherent view of itself or its environment it is difficult to conceive of a coherent set of strategies emerging even from the more responsive and adaptive models of organisation. Similarly Huff and Schwenk (in Huff, 1985) indicate that the ability of individual CEOs to sense what is relevant in the outside world is, perhaps understandably, highly conditioned by the state of the company. In good times they tend to be significantly less responsive than in bad times to the changing requirements of the environment.

Colin Eden (1989) in offering the SODA cognitive mapping technique as a means of achiev-

ing convergence among the different world views of participants in the strategic process, observes the overwhelming inconstancy of views. Each member of the group is viewed from the start as having his or her own subjective view of the problem. Similarly Mintzberg (1995) using the model of strategy as 'seeing' stresses the disparity of views which inevitably arise in the corporate sensing process.

All these authorities present a similar view of one aspect of organizational life, namely that the flow of information into the ambit of the individuals in an organisation will be imperfect in spite of the best (and sometimes the worst) of intentions on the part of the heads of the organisation. It must be observed, too that this information flow is often not merely failing in its flow from centre to periphery, from top to bottom, but fails too in flowing information inwards from informed individuals in contact with the outside world.

Cognitive failure

The human mind is one of the most effective cognitive systems we know, and yet it fails all too frequently to observe accurately the world in which it is immersed. It would be inappropriate here to review the massive literature of behavioural and cognitive science, but a few authorities fall on the management science side of the frontier, and these are assessed here.

Perhaps most comprehensive is Barnes' study (1984) of the impact of cognitive bias on strategic planning. He observes five main areas of bias.

Availability: People judge an event as likely if instances of it can be recalled easily and can be easily understood in spite of any evidence that it is fairly rare.

Hindsight : Knowledge of an event's occurrence increases the perception of that event's inevitability. We are not surprised about what happened in the past.

Misunderstanding the sampling process: We tend to give too much credence

to sparse occurrences of events, and place too much reliance when building theories on too few data points.

Judgements of correlation and causality: We tend too often to attribute causes to uncorrelated events

Representativeness: We fail to ask the question, 'How representative is this of the underlying process?'

Barns also observes (op. cit.) that here is also a common overweighting of the heuristic process. If it is based in experience then we tend to believe it to be true. Direct experience is unduly weighted in decisions. Managers tend to be very wary of probabilistic measures, and seek certainty from advisors where none can exist. Any opinion with an associated probability is distrusted, possibly because of a need for the specious certainty of expressed knowledge. The comforting illusion of control over an uncontrollable world is a powerful one.

Shrivastava (1983), Eden (op. cit.) and Huff (op. cit.) are all relevant to this complex area of study.

Einstellung Effect

The *satisficing* approach to problem solving, where the first feasible solution to be encountered which satisfies the minimal requirement is adopted, can produce fixation and stereotyping in the decision maker. The 'Einstellung' effect is where an initially promising solution path turns out not to be adequate as the details develop. We then become more and more in dissonance with the realities surrounding the choice, but reluctant to give up what was a once promising solution. Luchins (1942) has performed a series of experiments on the phenomenon, and Cyert & March (1963) observe similar effects. Kaufman (1991) gives a more general description of similar fixation processes.

Functional Fixedness

Past experience can be a burden in problem solving as well as a benefit. Duncker (1945) shows by simple laboratory experiments that we become locked into the use of objects in

particular ways. An example cited by Kaufman (1991) is the use of pumping engines exclusively statically for a hundred years before they were conceived of as being able to move themselves.

Deductive failure

In spite of our confidence in our deductive abilities there are many examples of its failure. There is evidence that in practice our logical abilities are perhaps not quite as sharp as we would believe.

Perhaps the most worrying aspect of recent research into rationality is the experimental work reported (Nisbett & Borgida, 1975) on the behaviour of subjects when presented with logical problems of a simple nature. The work shows clear evidence of human deductive failure even when the syllogisms required are essentially simple.

Intuition, as has already been discussed, need not be viewed as deductive failure, and there is an extensive literature (de Bono, 1969; Brunsson, 1982; Blackburn, 1983; Pondy, 1983; Shrivastava, 1983) which advocated a more relaxed acceptance of intuitive thinking, supporting the view that intuitive thinking is frequently more speedy, creative and less likely to be trapped in a suboptimal state because of its gestalt leaps of attention around a larger solution space than is generally accepted in linear thinking. Agar (1991) also discusses the use and acceptability of intuition among top executives.

Transcendence of rationality

Human beings are known deliberately to act irrationally (or at least as judged so by observers) because of obedience to a higher ideal than that expressed in the goals of the rationality being addressed. An identification with the social ideals of critical modernist and beyond, for example would be viewed as irrationality in the view of the instrumentally rational systemic modernist school. We see here an example of the inclusion of irrationality within a perception of rationality at a higher level, what has previously been called metarationality. Binmore (1994), in his extensive work on game theory applied to social situations makes this inclusion process a main part of his comprehensive argument drawing on the views of Rawls' *Theory of Justice* (1972) and of Rousseau (1913). He notes,

with regard to the social economic philosopher Sen (1987), *'I agree with Sen that an individual who acts only in his own narrowly conceived self-interest would often be behaving foolishly.'* Sen refers to these people as 'rational fools', and we should bear in mind when we judge rationality, both in individuals and in groups, that it is always possible that the irrationality we see is in fact the rationality of a higher ideal. Brams (1980) goes even further, in applying a metarationality using simple game theory to a number of encounters between individuals and their god, for example Abraham in the Old Testament. By clever inclusion of the goals of the participants in wider and wider rationalities he explains apparent paradoxes in their behaviour. Colman, (1982, pp. 254 -269) reports a wide set of applications of game theory to social situations, including a treatment of the social contract and its connections with strategy.

Emotion, too, is a kind of transcendence of rationality, and Howard (1971, 1993, 1997a,b) and Fraser & Hipel (1984) cover extensively the application of game theory to the emotional content of situations (also Bennett, 1986). Reputation effects are adequately covered in the economics literature, particularly in Fudenberg and Tirole (1993).

A third variety of transcendent behaviour is that of allegiance to a wider group than is recognised by those who are judging rationality. Olson (1971) shows us the immense effect which collective action and objectives have on the rationality of the participants. Price maximising firms, for example, in a perfectly competitive industry will act against their interests as a group. The result is a rationality which at the individual firm level is valid, but at the group or industry level is invalid. Macdonald, too (1975) gives a number of striking case studies in which the perception of the decision makers is constrained either by power exerted within the organisation or from outside.

Axelrod's (1980, 1995) work, together with that of Rapoport (1965) deals with the effects of reputation, loyalty and other socially derived attributes in stylised contexts, including a computerised 'world' in which the Prisoners' Dilemma game is played. The behaviour of individuals in supporting groups of like others is found not to be at all inconsistent with a

good return from the interactions, but there are significant difficulties when external predators enter a stable society. Axelrod's later work (Axelrod 1995) discusses the ways in which behaviour can be made to emerge by an evolutionary process in such a computerised model of society.

Force Majeur

A brief observation in support of the structural power technique is appropriate here to view the effects of constraining power within the organisation from the point of view of the individual within it. Nigel Howard (1971) gives a surprising insight, '*We suggest that among socioeconomic theories, Marxism theory, for example, failed at least partly because certain ruling class members, when they became aware of the theory, acted so as to disobey it.*'

Power in the organization can be exercised at any level of the rational model: of choosing between means to a declared end. The objectives can be dictated, the means themselves denied or made available, the criteria for judging acceptable styles of solutions and in some cases the deductive processes themselves can be shaped.

Rationality in Game Theory

Rationality Concepts in Game Theory

In its attempts to discover and impose structure upon the decision making of the participants in conflict, game theory is, of essence, concerned with the rationality of those participants. Right from the very start of its development, from von Neumann and Morgenstern's (1944) original work, the debate about rationality of decisions, the paradoxes which surround the behaviour of players and the types of equilibriums which surround them has raged unabated. We will see that there are significant weaknesses in the foundations of the theory which militate against the appearance of a theory of rationality which complies with wider human experience. This is not, of course, such a terrible criticism of the subject, any more than the observation that Newton's model of the universe is a poor one compared with that of Einstein.

In this section we shall discuss the definitions of utility on which rational choices are supposed to be based in game theory and examine their shortcomings. Next, we observe that game theory, and indeed most of economics, relies on the concept of the rational man to explain or model the behaviour of human beings operating under requirements of choice, and we observe the assumptions made about the nature of those choices and connect it to the concept of instrumental rationality discussed in a previous section.

Rationality is connected in game theory to the concept of equilibrium, in the sense that it is the purpose of game theory to find choice-sets for the players which reflect a supposed rationality for each one so that if there exists a solution in any sense, all the players are satisfied that they have done the best they could under the circumstances.

The work of Bacharach (1993) in discussing the effect of different belief-spaces of players is examined, since it bears upon the expanded definition of rationality discussed above.

Lastly some general observations on the relevance of the strict approach to rationality in game theory are made.

Utility

In standard economic theory the individual is supposed to act so as to maximise his preferences between outcomes in an ordinal way, expressed by utility cardinals. Generally speaking we can conceive only of utilities which are transitive, in the sense that if A is preferred over B and B is preferred over C , then A is preferred to C . This is not always true.

One of the most important contributions of von Neumann and Morgenstern (1944) was to allow the translation of this ordinal concept of utility in to a cardinal version, where a variable is established by which the degree of preference can be expressed. We can now speak of outcome A being twice as good as outcome B . Next we have to admit of a utility which is averaged over outcomes whose arrival is not certain, so that we have an expectation of utility. The essential normalising concept here is that of equivalent lotteries, where a subject can be asked questions which determine his indifference function between un-

certain outcomes. Theory then states that the utilities follow from the indifference functions.

There are considerable problems with these concepts. Hirschleifer and Riley (1992), for example, illustrate three paradoxes where subjects fail under laboratory conditions to distinguish the correct utility maximising choice, for example between bets in a lottery. The Allais paradox (Allais, 1953) gives similar results.

Some authorities reject the expected utility assumptions of the economists on this basis, arguing that the human mind does not operate in the instrumental way which they assert. Others, including Hirschleifer and Riley (1992), argue that we are simply seeing particular failures of the human ability to calculate probabilities. This seems to smack of sophistry, since, whatever the reason for the behaviour there are at least some cases where the individual does not behave according to the estimated utility rules, and we must therefore in practice assume at least some situations where irrationality (in the sense of compliance with expected utility assumptions) will appear.

Gauthier (1986) refers to the market as '*a moral-free zone*', implying that the rationality of the market is an optimising process involving the ordering of options on the basis of ordinal or cardinal utilities. This is not a very sophisticated way of accounting for human behaviour. In particular it does not generally account for the fact that our views of utility, if we have such and if we are that self-observant, tend to alter as we go through a sequence of occurrences. Although there have been attempts made to model sequential series of games (Rapoport 1965b, 1967; Snyder & Diesing 1971) where the outcomes of games lead into the next, the utilities of the games are fixed from time to time. Real life is different, however, since the information on the utilities of the players is not available necessarily to all; it is not necessarily available to the individual player himself, and is not necessarily constant from time to time.

There would appear to be two views why the rationality of players in actual games should depart from the rationality of the equilibrium solutions calculated (Camerer, Johnson,

Rymon & Sen 1993), namely fairness considerations and learning. Often players of games who are in a position to dictate extremes of return to the other player, do not in fact do so, but 'let him off the hook' and offer a position actually less advantageous to themselves. Second, there is evidence (Binmore, Shaked & Sutton, 1985; Fudenberg and Tirole, 1993 pp 145 - 203) that learning takes place during a game which rationalises the behaviour of players into a style more consistent with the game theory prediction. The latter case could be viewed as indoctrination of the subjects to comply with the expected basis of behaviour, namely game theory's expectations.

Rationality and Equilibriums

The embodiment of this rationality in game theory is the equilibrium. An equilibrium position is a set of choices made by each participant which results in a set of outcomes for each which is consistent with the choices each could have made and the assumption that each will act so as to improve his utility by the maximum amount. Thus we expect players to behave so as to reject choices which either directly or indirectly will result in things not turning out as well for them as they could have achieved. We also expect them to use whatever information is available to them in order to bring about these decisions, so that all information relevant and available is incorporated into the decision, either in terms of choices available, outcomes or other players' intents, outcomes or options.

The most commonly discussed equilibrium is that of Nash which is distinguished by its being rational for all the players in a N -player game. Specifically, there is no outcome to which any player can move by his own freedom of choice alone, which would improve his position. The concept often fails because of a plethora of solutions.

In conflict analysis terms, an extension of the Nash equilibrium is given in Fraser & Hipel (1984, pp 240 - 246) in the following broad terms. Firstly, outcomes are categorised according to the following exhaustive list:-

Rational Outcomes

Here a player cannot move to an adjacent tactical position unilaterally (i.e. through his own freedom of choice alone) which has a more advantageous outcome for him. Given the choice between staying at the present state or moving to a less advantageous position, the player acts rationally by staying where he is.

Sequentially stable positions

There may be positions to which a players can move immediately from which another player can induce a movement to a position which is more advantageous to the second player and which would result in a less preferred position for the first. In other words the first player could obtain a merely transitory improvement which could be denied him (unilaterally) by another player. Note that in order for any homogeneous rationality to apply the second player must be acting in a way so as to increase his own utility, otherwise the sanction (as it is known) would not be credible.

Simultaneously stable positions

Here we present the first player with a choice between the outcome of the present state or moving to another state where, acting alone or in consort with other players, another participant by moving simultaneously, can improve his own position.

Unstable positions

Here the player has a position to move to which improves his outcome without any other player being able to counter it. Again, the sense in which no sanction is available to the second player, is that he can only move to a situation which decreases the first player's utility by decreasing his own utility. Thus he must act according to a rule of rationality.

One of the interesting aspects of the Fraser & Hipel approach (and indeed of Howard's

(1971) work) is that transitivity is not required. It is entirely possible to achieve stable results in the sense described above while having a circular relation between any player's valuation of outcomes of situations.

We must also cover here some adjacent equilibrium concepts which may be important in a theory of rationality for strategic conflict. These are non-myopic equilibriums, Stackelberg equilibriums and Pareto optimality.

Non-myopic equilibrium

This is the result of work by Brams and Wittman (1981) (Brams, 1985, pp. 66 - 74) who envisage an equilibrium concept based on the idea that with sufficient knowledge of the outcome of a complex sequential game players can act so as to avoid chains of play which lead to an outcome which is eventually discovered to be less advantageous. This sounds very simple, but it has a number of weaknesses. First, Brams and Wittman have to date only encompassed a small number of steps while some sequential games may in practice be played a significantly larger number of steps. More critical is the problem that in some games no equilibrium in this sense can be found.

Stackelberg equilibrium

Here the first player makes his choice by optimising his position with due account of the second player playing after him, whereas the second player plays in full knowledge of what the first has done.

Pareto Optimality

The Pareto optimum is achieved when there is no other outcome at all which is preferred by any other player. The concept ignores the path which may be necessary for an outcome to be achieved.

It should be noted that these concepts of conflict equilibriums are similar to those of Howard (1971) and are explained in Fraser & Hipel (ibid. pp. 214 - 216)

Knowledge

Although the literature on the effect of knowledge in game theory, particularly in the economic field is extensive, it is not proposed to review it as such. Rasmusen's (1989) treatment is exhaustive.

The important and new work by Bacharach (1993), however, deserves particular attention. Bacharach concerns himself with the question of rationality under conditions where the extents of knowledge of the participants is different in a cooperative situation. He cites two games, one, the well known *Rendezvous* game where cooperating players have to agree with no knowledge or communication on a place to meet in a city, and *Blockmarking*, a more artificial situation where coloured blocks are marked independently by the two players without mutual knowledge. If the same block is marked by both, they both win. The essence of Bacharach's approach is that each player has to make assumptions about the knowledge possessed by the other. Moreover, he must not assume that the other has more knowledge of his own belief-space than the other actually has, because in the *Rendezvous* game assuming that the other player thinks you have less knowledge of the city in question is at least as bad as overestimating knowledge.

The result of Bacharach's work is that we have the beginnings of a theory of disjointed information which will bear greatly on the concepts of rationality and the method of representation to be applied in the approach of the present work, of which the essence is the differing views of the participants of the field of play and the implicit utilities of the participants.

Lastly Hammond (in Binmore, 1993) draws our attention to the requirement that the Nash and other equilibriums require there to be a common expectation, i.e. that there needs to be a common joint probability function over all players' strategy choices.

Summary - rationality in Game Theory

A number of conclusions can be drawn and some observations made on the nature of rationality in game theory and the relevance to the present approach.

First, at the level of the economic games rationality is inextricably rooted in the instrumental rationality of *homo economicus* and systemic modernism. There is little prospect of applying these models outside a limited domain of sub-problems. Within these sub-problems, however, the rationality applied is entirely appropriate. It requires a common view of outcomes and, generally speaking, the structure of the game is held as common knowledge by the players.

At a strategic representation level, however, that difficulties are encountered. On occasion we will meet behaviour on the part of the other participants which appears irrational, and we must be aware of the sources of this. It is most likely to stem from a disjunction of view among the participants. This could stem from the outcomes, the definition of the game structure or the tactical choice made within that structure. We can hold on to the concept of rationality as the bounded rationality of imperfect knowledge, while attempting to draw conclusions from the behaviour and, indeed the communications of the other participants in order to reconstruct their belief-space. The concept of rationality, then, is subsumed under a wider model of reasonable behaviour which encompasses the idea that the other players may not see the world as we do. Similarly we may not view the world as they do.

Third, when the idea of a dynamically changing game is added, there is another layer of rationality to absorb. In a static view of conflict, there exists the luxury of an essentially static universe upon which the participants are seeking to converge, and a critical modernist view can be maintained — that by observation of the speech-acts of the others we can achieve a greater understanding of the 'real world'. In a dynamic conception, however, the possibility exists that there may be a large number of entirely reasonable parallel real worlds, all conceived of by different players, and all constructed on the basis that in each transaction between the players, new concepts of reality will be created. These will result, for example, in fresh appraisals of

relative weightings of outcomes

desirability of outcomes

availability of tactical choices

other players' utility choices and tactical options.

This represents a new and challenging rationality in game theory terms, parallel in many respects with the post-modernist concept of alternative realities which must be reconciled with a practical need for a solution method.

Criteria for strategic conflict decision support

While the main conclusions drawn from this section regarding the required attributes of a strategic conflict decision analysis tool are withheld until they can be put into the context of the material of chapter 3, some preliminary observations are appropriate here.

It is observed that the critique of the anti-relativist position leads to the conclusion that at least at the higher levels of representation (i.e. at the more strategic and global level of any hierarchy of models), the methodology should take account of the discontinuities between the world-views of participants. It must be accepted that different participants in the struggle will have different views not only of their objectives, but also of what the very nature of the struggle is. In Habermas's (1984) terms we observe differently a single lifeworld which is fundamentally inaccessible to each of us. Our subjective worlds are necessarily different and we can have no common access to the underlying lifeworld. Communicative acts can bring us closer to a common view, but never to an identical one. Thus we observe that any satisfactory model of strategic conflict (or indeed of any social structure) must have the capacity to comprehend conflicting alternative views of the structure under examination.

Regarding the interference of human beings in the process, it is observed from the discussion so far that the arbitrary nature of human motivation must become an appropriate part of the structure of the conflict. The representation of conflict should be anthropic, in the sense that the human beings become part of the decision process rather than external to its representation.

Lastly, at this stage, one would observe that an intuitive/deductive approach to the conflict resolution is likely to be more effective than any appeal to a strict logical positivist approach.

Other conclusions are dealt with in chapter 4 where a full list of the main requirements of a decision support methodology resulting from this appraisal of rationality and knowledge in the strategic process are laid out. The above extended examination of the problem of strategic conflict management and the underlying characteristics of its process lead us to certain observations on the characteristics which are necessary appropriate or simply desirable for any technique which is aimed at supporting decision making in conditions of strategic conflict. These criteria of goodness derived here will be used later in the work as a benchmark for the appropriateness of an overall framework (called the foveal game approach) and for a particular embodiment of that framework which is trialled in practice.

Requirements deriving from the characteristics of strategic decision making

Certain key points emerged from the discussion above of the process of strategic decision making itself. These points are integrated in Table 4 below, which correlates them with the sources from which they are derived.

First, decisions are necessarily made in an environment of uncertainty and deception. Data is essentially limited because of lacunae in the present scene, because of the delay factor between present action and future results (the prediction problem) and because of defects and errors caused in the perceived scene either through self-induced errors in sense making or because of deceptive action on the part of the other participants. It should thus be *acceptant of limited, or indeed deceitful data*, and should ideally, be capable of *improving that data*, through additional structuring, for example.

Second, there is a strong connection between different layers of decision making in organisations. Both the synoptic school and the incremental school are bound in their strategic product by the realities of the situation, so that even in the most extreme synoptic

approach, the CEO as strategist will be governed by expressions of practical feasibility generated by the body of the organisation. Similarly the logical incrementalist organisation, generating its emergent strategy throughout its structure is nevertheless constrained and mandated by strategic statements emerging, if not from a synoptic head, at least from the collective view of what the strategic focus of the organisation is or should be. In other words the synoptic school declares strategy and is constrained by feasibility, and the logical incrementalist school declares feasibility or operational desirability and is constrained by process and objective values which are emergent properties, but which are nevertheless very real in their effects. There is thus strong connection between lower (more operational levels) of decision making and the strategic levels. The process should thus be *capable of depth changing* between levels of decision making in an organisation.

Third, strategy by its very importance is a process highly integrating in its effect, in the sense that the ripples of a strategic decision made in one participant's organisation will be felt in the board rooms or cabinets of other participants. Strategy is a high energy system, in physics terms. It is highly connected. The existence of the large body of economic game theory models of behaviour supports this, in that the base assumptions of such an approach takes for granted that the players' actions are going to affect the perceptions or achievements of others. Because of this and because of the relatively long term nature of strategic behaviour, we can observe that teleological behaviour alone is inappropriate, since by the time we have reached the vicinity of the objective which we declared at the time of the strategic decision, other participants' actions and the vagaries of the strategic environment may well have rendered our achievement of that particular objective no longer relevant. We therefore need a strategic decision making tool which is sensitive to the changes in objective which may take place while our strategies are being implemented.

Table 2 above, from Rosenhead (1989b, p 12), can be seen to reflect these emergent requirements, particularly in respect of the need for an *ateleological behaviour* and the need to mobilise a wide range of input data types, specifically *both hard and soft data*. Other similarities will emerge below.

Requirements deriving from rationality considerations

The rationality considerations above lead us similarly to a number of clear conclusions regarding the desirable characteristics we should seek in a support methodology. Again these are summarised, together with their derivations, in Table 4 below.

First, we note that rationality, both as something we expect in ourselves and something which we seek in others is essentially a human trait. It is subject to the vagaries of human will in terms of its objectives and process judgements. Often we judge the behaviour of a competitor as irrational because we have no view of her belief space, particularly with regard to the weightings she places on various outcomes. We need the process to be *anthropic*, in the sense that it recognises that the strategic decision making is run by and for human beings, with all their arbitrariness and unpredictability. In particular, we note that the representation of other parties in the decision support methodology needs to reflect that they may not be perceived to be behaving rationally, but their actions and utilities nevertheless need to be represented. This ability to represent arbitrary apparently irrational positions is strengthened by the observations above on the nature and causes of rationality failure on the part of the individual. In the vocabulary of the previous part of this chapter, the process should be *anthropic*, recognising the pre-eminence of the human beings as part of the system in focus.

Second, the judgement of what constitutes a valid contribution to rational decision making needs to be perceived as being syllogistic, correct in reasoning. In order for that to be seen to be so, therefore, any decision support method must be *auditable, transparent* in Rosenhead's sense, so that it can be checked for correctness of structure. A structural power critique of this requirement, however, places suspicion on such an unbiased need; the requirement for transparency may simply be placed by the ruling power group in the organisation in order to detect interference by another.

Third, the resultant epistemic position of the rationality discussion above is essentially relativist. The communicative rationality views of Habermas (1981), who, in building upon the essential relativist position of Schutz and Luckmann (1963) becomes himself a relativ-

ist, appearing to provide an appropriate compromise between those who fail to apply a scientific method to management research because it is unable to be applied, and those who fail to provide any conclusions because they adopt the ultimate relativism and equally ultimate sterility of the post-modernist position. The conclusion for the strategic conflict resolution toolset is that we *must be able to take into account arbitrarily differing belief spaces* (Bacharach, 1993) in order to accommodate the essential relativism of the strategic decision world.

Fourth, the requirement emerging above for *auditability or transparency* is supported by the examination of rationalism in the context of knowledge, as part of the 'justified' element identified there in the shibboleth, 'justified true belief'.

Fifth, the work of Flood (1990) and of Ulrich (1983) is represented in this set of requirements by accepting their set of five characteristics quoted above (page 62). In particular it is accepted that a critical awareness of assumptions and values (characteristic 1, above) and the two complementarity requirements (characteristics 4 and 5) add specifically to the requirements declared here, whereas the remaining characteristics are already subsumed in previously derived criteria of goodness. One of Flood's characteristics (number 3, a dedication to human emancipation) is rejected. Flood's critical system thinking was directed towards conventional social systems, and whereas one would seek to espouse some greater meta-economic aim for corporate-based struggles in particular, one must accept that the universe of action and discourse of the strategic struggle is more limited than that of the original domain of Flood's design. Emerging from Flood's design, then are the following criteria: the method should be *based on the power of participants to direct the conflict*; it should be *sensitive to the social context*; it should be *complementary to existing systems methods*; it should be *adaptive*. Other requirements identified here are also supported in a more general sense by Flood's work.

Sixth, Jackson's related observations on the importance of the structural power critique (*... power, which is central... is largely ignored ... and is treated simplistically*) (Jackson,

1991b) form the basis for a view of strategic struggle which is essentially a power analysis. *Motivation, power and structure* would appear to be the three central elements required if the support methodology is accurately to represent the need implicit in the late modernist/post-modernist dialectic.

Seventh, the examination of rationality of equilibriums in game theory indicates that the conventional equilibrium definitions are unsustainable in the light of the emergent characteristics, notably because of their requirement for perceived rational behaviour on the part of the participants. The requirement, here, then, is more negative in nature, in that it is *not deemed essential to adopt the conventional game theoretic definitions of equilibrium*.

Summary of requirements for a strategic conflict decision making support method

The requirements implied and derived above can be summarised in the following thirteen features which appear in Table 4 together with the specific authorities from which each requirement derives. Each feature noted here derives from a number of points emerging from the previous sections.

- 1) The method should be based on the power, motivation and potential of participants to control and direct the conflict.
- 2) It should not be bound by conventional game theoretic views of what constitutes equilibrium.
- 3) It should be acceptant of differing belief spaces on the part of participants as regard rationality, objective, structure and intent.
- 4) It should not be end-directed (teleological) in the sense that as a situation develops it should not require that the original aim point should be maintained necessarily. In other words it should be adaptive to changing circumstances.
- 5) It should be acceptant of limited, defective and deceitful data.
- 6) The method should be data improving, using newly perceived structures in the conflict model to provide new insight into data.

Summary of requirements for a strategic conflict resolution method

Relevant page of
this work

Source references

Internal process

Based on power, motivation and potential	62-66, 95	Ulrich (1983) Flood (1990) Jackson (1991 a,b) Churchman (1979) Ackoff (1974, 1981)
Not bound by game theoretic definitions of equilibrium	86-91, 95	Howard (1971) Fraser and Hipel (1984) Axelrod (1980, 1995)
Depth changing	28-29, 33, 94	Rosenhead (1989 – criterion 5) Marsh (1995)
Data-improving	32-36, 92	Rosenhead (1989 - criterion 6) Rittel (1973) Noorderhaven (1995)
Simple, auditable and transparent	28-29, 33	Rosenhead (1989 -criterion 3)

Epistemic assumptions

Differing belief spaces	32,33, 64-76, 92	Rosenhead (1989- criterion 6) Bacharach (1993) Checkland (1981) Quine (1960) Mintzberg (1995) Eden (1989) Habermas (1984)
Acceptant of limited, deceitful and defective data	28, 32-33, 77-89, 92, 95	Rosenhead (19889- criterion 6) Eden (1989) Mintzberg (1995)
Using hard and soft data sources	32-33, 72, 73, 92	Rosenhead (1989 – criterion 2) Checkland (1981, 1984a) Jackson (1991a)

Contextual

Adaptive (ateleological)	29-32, 95	Rosenhead(1989 – criteria 1 and 6) Checkland (1981)
System-centred vis-à-vis self-centred	72-74, 93	Checkland (1981) Garratt (1995) Habermas (1981, I, pp 8-42) Jackson (1991c)
Anthropic	32-40, 43-61, 67-70, 94, 95	Rosenhead (1989- criterion 4) Howard (1971) Olson (1971) Habermas (1981, I, pp 8-42) Vickers (1983)
Aware of social context of intervention	74-76, 95	Ulrich (1983) Flood (1990) Olson (1971)
Complementary to and contributory to systems methods	74-76, 95	Ulrich (1983) Flood (1990)

Table 4: Criteria for Appraisal

- 7) It should be anthropic, in the sense that it will accept the human elements of the struggle with their vagaries and apparent irrationalities.
- 8) It should exhibit a depth-changing ability between tactical and strategic levels of decision making.
- 9) It should be system-centred, in opposition to self-centred. In other words, it should not view the struggle exclusively from the viewpoint of one party.
- 10 It should cope with both hard and soft data sources
- 11) It should be simple, auditable and transparent
- 12) It should be aware of the social context in which it operates and should be aware that its acceptability is itself a social phenomenon
- 13) It should be complementary with and contribute to the development of existing systems methods.

Chapter 3: Existing approaches and their shortcomings

Introduction

Conflict, as has been seen, lies at the heart of much of human endeavour and interaction, and as such has engaged many intellects. Some, as in the case of game theory or conventional conflict analysis in the general sense, have conflict as their main and central focus, while others approach conflict indirectly, having, as their subject, a more general interest of which conflict is often a part, but which is seen as a somewhat tiresome additional factor in an already complex problem situation. A number of management techniques fall into this latter category.

In this chapter these bodies of knowledge will be reviewed within the context of the problem defined above. The extensive literature is divided into the following parts:-

1) **General conflict resolution methods**, stemming from the international relations literature and which is characterised by a generic approach, strong on description and taxonomy, but necessarily weaker in the normative and specific features required of a specific strategic conflict management technique.

2) **Game theory**, originating with the work of von Neumann and Morgenstern (1944) and extensively and enthusiastically adopted by the economics community as a numerical basis for the study of behaviour of groups and individuals under conditions of conflict of interest, measured by economic utility.

3) **General system approaches** to problem description and solution exemplified by the soft systems approach of Checkland (1989) and others. These approaches tend to be general in their applicability but less strong in determining the detailed descriptions and normative action planning product required by a strategic conflict resolution method.

4) **Specific conflict analysis methods** and, in particular, the work of Howard

(1971) and Fraser and Hipel (1984).

From a study of these four areas emerge not only a critique of their shortcomings, but, more positively, an understanding of the different styles of contribution of each, from which a framework for strategic conflict resolution will emerge in Section IV.

Conflict resolution - the international relations approach

Differences of objective

The literature of the international relations (IR) community can be neatly divided into that dealing with the resolution of conflict and that dealing with its description. Both have as an underlying assumption the desire to remove conflict, to resolve it. As Chestnut (1986, p ix) explains, IR seeks *'to identify conflicts in their early stages and to develop and establish more effective means of conflict resolution as a way of resolving and settling international disputes'*. The IR agenda is *'... to develop more acceptable and less destructive ways of resolving international conflicts than the current military methods of solution'*. A non-European view is that *'[t]he objective in a proper conflict resolution should be either to prevent such a situation [conflict] or to see that such an attempt by one of the parties does not affect political, economic and cultural viabilities of the other party.'* Murthy and Pai, (1986, p73) Azar and Burton (1986, p86) are clear on the objective of the process. *'Resolution in this sense means that a new set of relationships will eventually emerge which are self-sustaining and not dependent for their observance upon outside coercion or third parties.'*

Conflict itself is defined, too, in a somewhat restricted fashion. Conflict consists of *'phases of initiation, escalation, controlled maintenance abatement and termination/resolution.'* (Sandole and van der Merwe, 1993, p6) Conflict involves *'at least two actors... [who] pursue their perceptions of mutually incompatible goals by physically damaging or destroying the property and high-value symbols of one another; and/or psychologically or physically injuring, destroying, or otherwise forcibly eliminating one another.'* (Sandole, 1980)

In commercial conflict many similarities with these two sets of definitions exist, but there are a number of important differences. Firstly, the nature of the conflict in commerce is different. Firms are not concerned with the physical destruction of a competitor's assets, but (merely?) with the maximization of their own benefit (Johnson and Scholes, 1997; Bowman and Faulkner, 1997 *passim*). Generally, the methods used are not the same as those assumed by Sandole (*op. cit.*) and others (Mitchell, 1981; Mack, 1965; Boulding, 1962; Schelling, 1960); rarely do we find companies engaged in the type of direct action assumed by IR practitioners. There are, however, sufficient similarities at the fundamental level such that seeking assistance in the IR domain is not *prima facie* useless in the analysis of commercial conflicts. Secondly, there is a fundamental difference between the very objectives of the interested parties in international disputes and in the pursuit of business aims. The role of international relations is to resolve conflict. The role of industrial strategic analysis is to resolve conflict in the favour of the client. In other words, the position of the firm in strategic conflict is analogous to that of the interested party, the individual country, in the IR problem. There is little or no recourse in the industrial case to the apparently independent position of the third party in the IR problem. Of course, this position of independence is of itself interested, albeit in a different timescale and for ostensibly universally beneficial ends, but it is, nevertheless, an interested position, even if it is to ensure that the resolution of the conflict is aligned with some pre-defined criteria of acceptability to the constituency of the international arbitrating/mediating third party.

The difference between conflict resolution and conflict analysis used here is one that is generally used in the IR literature, and is employed to distinguish between two different approaches, **conflict resolution**, which, as we have seen, concerns itself with the achievement of a stable solution to conflict acceptable to the world community (a somewhat restricted solution set) and **conflict analysis**, which is a set of techniques used within the framework of conflict resolution in order to predict the behaviour of certain elements of the IR conflict.

Conflict Resolution

The approach of the majority of the IR literature towards the behavioural aspects of conflict is typified by the work of Mitchell (1981), Azar and Burton (1986), Sandole and van der Merwe (1993), Swingle (1970) and Chestnut (1986). Each of these works is a compilation of papers by other authors which together give a *tour de horizon* of the assumptions and attitudes implicit in the IR view of conflict.

As has been observed, the central tenet of all these works is that conflict is something outside the international bodies which is dangerous, undesirable and to be reduced or 'resolved'. We see extensive discussion of methods by which parties can be brought to a greater understanding of the world views of their fellow troublemakers — *'parties ... thus learn about themselves and their relationship with their adversary from their own behaviour, from their adversary and from a third party.'* (Azar and Burton, 1986, pp85, 92-116) (Mitchell, 1981, pp44-45). The process of resolution of the conflict is seen as essentially one of praxis, to which the subjective is as freely admitted as is procedurally based, analytically derived understanding (Azar and Burton, 1986, pp117-124, 141-153). Conflict resolution is primarily seen as problem solving whereby a party external to the conflict in some sense 'takes charge' of the situation and by intervening reduces it as a surgeon does a dislocated joint. This is essentially a different approach from that of the industrial conflict, where the participants have no recourse to a third party, and, moreover, may not want the situation reduced; the industrial conflict, on the other hand, may be part of a continuum of relations which can extend from direct confrontation of interests to ephemeral and superficial disagreements within an essentially stable and cooperative business relationship. The essence of international relations from the point of view of the community at large is to reduce conflict; the essence of industrial behaviour is to provoke appropriate conflict (in Mitchell's sense) in order to exploit market mechanisms. *'Problem solving is to look for superordinate goals, that is, goals which both sides individually want but can only get by cooperating together'* (Azar and Burton, 1986, p89) in IR conflict resolution, but not in industrial conflict, at least from the perspective of the participants. The contrast between

this literature and, say, Porter's market force model (Porter 1985) or Ansoff's (1987) corporate strategy framework is striking in the sense that the commercial objective is clearly to resolve the conflict but **in the favour of the client company**. The essential difference between the two literatures is that of perspective and objective function.

There is a certain concentration in the conflict resolution literature, too, on the process of problem solving. The process of conflict resolution is seen as a procedural problem. If a 'good' process is established, the scales will fall from the eyes of the antagonists and the situation will be resolved. (Azar and Burton, 1986, p89, 98-116; Saaty, in Chestnut, 1986, pp91-94; Ascher and Brown in Chestnut 1986, pp95-102). Sandole and van der Merwe (1993, pp70, 71) deal with the difficulties of obtaining cognitive equilibrium and emotional equilibrium in the resolution process in an attempt to achieve what they refer to as 'components of serenity'. Mitchell (in Sandole and van der Merwe, 1993, pp78-94) relates techniques of progress to the phases of a conflict according to his general theory (Mitchell, 1981).

The behavioural explanations and models adopted are eclectic. There is substantial discussion of the origins of the conflict (Clark in Sandole and van de Merwe, 1993, pp43-54) (Mitchell, 1981, pp43-44, 124) and of the origins of power and influence and misconceptions from an essentially internalised view. The argument is more about the cause of the conflict with a view to its reduction than an acceptance that a conflict exists in order to cope with the consequences of its existence. The approach can be taxonomic. Raven and Kruglanski in (Swingle, 1970, pp69-106) give a full analysis of the nature of power relationships within generalised conflict, with a view to understanding the ways in which that power relationship could develop. They indicate the differences between power originating from expertise, from situation, from coercion and the prospect of reward. The perspective again, is that the objective is to reduce the antagonism, rather than necessarily to secure a favourable position for the parties. Some of the literature is concerned with a taxonomy of causes which seeks to establish a hierarchy of conflicts, from those which

stem from basic human needs through learned and socialised values and interests towards the highest level of conflict, namely the political and strategic level (Lau and Sears, 1986). A correlation is then made between the level of conflict and the choice paradigm, with greater rationality entering the process as the level of conflict rises in the hierarchy.

Mitchell's (1981) analysis of the dynamics of conflict is at first glance a useful insight into the ways in which conflicts can develop, but on closer examination it develops into a set of observations of the ways in which the tensions in a situation of diplomatic intervention develop rather than the prediction of the dynamics of the situation of conflict as such. His observation that a conflict's progress is determined by situation, behaviour and attitudes often in unequal measures is a useful characterisation of the nature of the problem but fails to provide specific advice for a specific situation. It is as if we were in possession of a handbook of flora but had no literature on farming methods or the cultivation of plants.

The inconvenient conclusion, then, is that because of the specific rules of engagement of the IR literature on conflict resolution, and, in particular because of the specific objectives of the process, only limited assistance can be expected from the conflict resolution work. Essentially the difficulties are

- a) the objective of the work is to assure the reduction of conflict rather than to predict or manipulate its progress
- b) the prediction processes which are discussed are to do with the progress of generalised conflict resolution process rather than the progress of a conflict in the outside world
- c) the descriptions of causal behaviour are too generalised to be of use in a particular conflict situation
- d) the perspective is one of a third external party rather than of a participant.

This is not to say that the literature of conflict resolution is not useful. Far from it; it provides an extensive foundation for the particular set of problems it is aimed at solving,

namely the assurance of stability in the international arena.

Chestnut (1986, page x) indicates clearly where the analytical initiative lies. *'At the level of the multinational corporation, as well as at the level of the large industrial firms within a nation, many of the same causes for conflict exist as those which produce international conflict. Ways have been found in the commercial world for resolving such international conflicts without resorting to military force as a basis for conflict resolution. Perhaps more thorough studies of such non-military means of conflict resolution should be made and could prove important.'* While one would disagree that the industrial community have developed truly effective ways of managing strategic conflict, it is clear that it is largely inappropriate to look within the conflict resolution literature of the International Relations community for effective specific solutions.

There is significant work, too, on the tactics of negotiation. While much of the material is concerned with examples of financial negotiation, covered below, the impact of psychology and power relationships between participants is discussed. Swingle (1970, pp45-68) addresses the effects on negotiation of toughness in bargaining within a socioeconomic structure which allows the identification of the effects of gender and other social discriminants on behaviour. While this type of work is most valid, and allows some insight into the detailed structure of negotiation, it is less helpful in detailing the type of strategic normative structure which is the aim of this work. Similar criticisms can be levelled at the conflict analysis work which seeks to present a behavioural psychological analysis of power in conflicts. Raven and Eachus, (1963), Raven and French, (1958), Mintz (1951) and Thibaut and Faucheux (1965) all adopt this approach. The analysis is insightful at the level of interpersonal relations in negotiation, but less helpful at the level of intercompany conflict. To the extent that interpersonal relations in a specific conflict dominate the outcome of that struggle, the work of these authors will be relevant.

Similar, equivalent work exists for the discussion of coalition power (as distinct from the individual power discussion of the previous paragraph). Here we find a number of competing

theories which can be summarised as

minimum resource theory, where the coalition forms on the basis of providing the minimum resource necessary to achieve the desired result

minimum power theory, where the coalition forms using the minimum power necessary

anti-competitive theory, where in certain social situations persons act so as to create the minimum social tension

and **utter confusion theory** [sic] where coalitions are deemed to form on a random basis (Gruder, in Swingle, 1970, pp111-154), (Gamson, 1964)

While these theories are interesting they would not appear to be sufficiently robust or applicable to specific situations to provide any strong basis for development under the present requirement.

These brief commentaries on a large literature of behavioural models of conflict aim to summarise a position on the relevance of that work as appropriate for the small scale prediction or description of behaviour in a conflict (specifically, a bargaining) situation. There are serious shortcomings, however, as far as their appropriateness as a foundation for a strategic conflict resolution tool, either in IR or in industrial use. In terms of the criteria of Table 4, these methods are unable to change depth from the symptomatic level of their design; they exhibit no ability to move from the level of individual behaviour to encompass the relations between group and corporate entities. While they are strongly anthropic and aware of the social context of intervention (requirements 11 and 12), they stand completely apart from the system methods and there is little hope of achieving a bridging between theories which predict conflict by examining its sources and theories which predict the behaviour of conflict in order to manage it. Criticism of the non-game-theoretic systems models is of a slightly different nature. By failing to encompass the essential competition between the objectives of parties, these models remain at the

descriptive and generic level and form little basis for an appropriately detailed conflict management tool.

There is a clear dichotomy between the analytical, mathematical tools and the writers on behavioural models, summarised by Swingle (1970, p3) as follows. *'... the principles of conflict resolution as they emerge in game-theoretic analysis have nothing to do with such matters as reduction of hostility, redefinition of goals or interests or the like. Certain 'equity' principles are, to be sure, invoked in bargaining theory, but only to the extent that they reflect symmetries in the strategic positions of the players - hence, purely structural features of the game itself, not the psychological characteristics of the players. In short, game theory is a 'depsychologized' decision theory, dealing with situations controlled by more than one decision maker.'* Swingle's criticism is a sound one, but the implication - that because game theory is inadequate, a psychological approach is sufficient - is incorrect, too. Swingle also makes the observation (1970, p39) that *'[Game theory] must abstract entirely from all the psychological or sociological factors of conflicts, thus sacrificing immediate relevance for logical precision.'* It is the aim of the present work to bridge the gap between the two approaches.

In terms of the criteria of Table 4, the IR community's methods fail primarily because they do not offer any specific prediction of the development of a conflict. *'Conflict resolution... is not primarily or even mainly concerned with particular cases.'* (Sandole and van der Merwe, 1993, p60) They fail to comply with any requirement of internal process (requirements 1 to 5) because the objective is incompatible with the management of the conflict in the present sense of developing the interests of a participant. Their objective is too limited to allow any substantial transfer of technique from this area.

Nevertheless it is clear from the work of Mitchell (1981) and Sandole and van der Merwe (1993) that the essential characteristics of conflict in both areas are similar. Mitchell (1981, p3), for example, makes the observation that *'[c]onflict between New York cab drivers' organisations could conceivably contain elements similar to those present in a conflict*

between independent sovereign states. Similarly (ibid. p4), *'something which can, for convenience, be called "conflict" exists throughout human experience, extending from the individual to the interstate level'*. Boulding (1962, p1) comments, *'conflict does exhibit many general patterns, that the patterns of conflict in industrial relations, international relations, interpersonal relations and even animal life are not wholly different from one another, and that it is therefore, worth looking for the common element... It is my contention that there is a general theory of conflict that can be derived'*. We shall see below in the examination of the subjects of the game theory analyses which originate from this area, that there is much in common between the objects of interest of the two communities. It is justified, then, to look for examples from the IR literature in order to test and develop a general conflict management toolset.

Associated with the conflict resolution literature is a body of work referred to here as conflict analysis and covered in detail below in the analysis of the work of Fraser and Hipel (1984) and of Howard (1971). Its aim, unlike that of conflict resolution is to describe the behaviour of participants in conflict situations. In this respect it takes a similar perspective to the present work in that it is not *per se* attempting to reduce the level of conflict in a particular situation. Moreover, whereas conflict resolution in the IR field, as we have seen, is concerned essentially with generalities, conflict analysis aspires to more particular solutions. Conflict analysis in general draws heavily on the general theory of games, and as such is discussed in that section, but whereas game theory applies itself to economic and other problems in rather a wide sense, the conflict analysis material concerns itself with game theoretic and other approaches to the prediction of the dynamics of conflict.

System Approaches

There are a number of general systems analysis approaches aimed at planning under various conditions of uncertainty. These originated in the OR community as a reaction against what was seen as an unnecessarily restrictive set of approaches which did not take adequate account of the 'soft' aspects of system intervention.

Robustness Analysis

The method developed by Rosenhead (1989) and practised by Best et al (1986), Caplin (1975) and others is a natural response to the desire to adopt a strategic solution set which reflects the uncertainties inherent in any situation. Every attempt at the definition of a strategic path is beset by the uncertainties induced by errors in the data, the duplicity of competitors, the policy changes of procurement authorities, the death of statesmen and princes, and the plain intractability of adequately rich problem definitions. Inherent in the strategic process is the uncertainty of the scenario which constitutes the foundation of the process - by the time the implantation of the strategy is complete the probabilities are that the foundation assumptions have changed. Robustness analysis attempts to maximise the likelihood that the path embarked upon will result, under uncertainty, in a good result.

It does this by a breakdown of the possible results in a tree form. Each result is ascribed a desirability level, and simple analysis is carried out to produce, effectively an *a priori* likelihood estimate of there being a desirable outcome. Extensions to the basic approach cover the avoidance of catastrophic outcomes by means of a debility matrix. The process is attractively illustrated with a case-study of choices in secondary school for the author's daughter in Rosenhead (1989).

As part of a suite of contributory tools robustness analysis has many attributes. It is essentially eutaxiological in that its fundamental aim is to make robust the choice of the first step along an unknown path. It is highly forgiving, transparent, data-pragmatic and anthropic. Its limitation is perhaps that it is too convergent. Other methods such as metagames have the advantage over it of presenting two-dimensional interactive diagrams which promote connectivity of ideas, whereas the dendritic structure of the robustness structures tend to draw the mind to linear examinations and extensions of existing part solutions. It would seem at this stage that robustness analysis is more likely to be a tool used at a particular stage in a conflict analysis to address the robustness of emergent solution-sets rather than a tool of first resort to structure a 'wicked' conflict management problem

ab initio. In terms of Table 4 it is defective in that it does not adequately comprehend the different belief spaces of participants (requirement 6) and that it is not essentially depth-changing in its performance. More generally, it is an inadequate basis for proceeding to a general conflict management tool because of its lack of definition in the specific dynamics of a system representation.

Strategic Choice Approach

This portmanteau of techniques, attitudes and methods originates in the local government area of management and is strong in its ability to cope with what Friend (in Rosenhead, 1989) refers to as '*... two realms of decision making - the construction industry and city government - in which powers of decision are widely diffused, and much depends on collective processes of negotiation and debate.*' He makes the point that the process is '*empirical rather than intellectual*' and this is strongly represented both in the case studies (Fridn and Hickiling, 1987; Friend, 1989) and in the style of exposition.

An attractive part of the method is the recognition of the uncertainty of the environment in which the strategic process is taking place. Friend has three types of uncertainty

- | | |
|----|--|
| UV | Uncertainties pertaining to guiding values |
| UE | Uncertainties pertaining to the environment |
| UR | Uncertainties pertaining to related decision fields. |

This is a valuable structure but it does not recognise what in strategic decision-making is a key distinction between those uncertainties which are properties of a neutral but not always convenient universe (the earthquake destroying the offshore production line) as distinct those which are properties of agents which are actively in opposition, wholly or partly, to the desired end-result (or development paths). This distinction is crucial, particularly when extended to encompass the distinction between those uncertainties which are controllable or removable and those which are not. The distinction between game theory and control

theory is relevant here, as is the difference in design approach between a complex software system designed to cope with random failures as distinct from one designed to cope with terrorist or criminal attacks. The approaches are very different. Nevertheless, the explicit recognition of uncertainty is a useful and often neglected part of decision making, and the Strategic Choice approach is strong in this respect.

Also useful is the elucidation of four stages of decision-making, shaping, designing, comparing and choosing, and the attention to each of these phases required by the process is a useful structuring act; it is often the case that decision making groups tend to rush to the deciding domain before they have even understood the question.

It is at this point, however, where doubt begins to enter about the applicability of the process. To what extent is its success the effect of the charisma and individual intellectual flexibility of the consultant, and to what extent is the method itself adding value? Like the French '*enarque*' one is tempted to observe that it may be excellent in practice but it will never work in theory. This is not an inconsequential jibe; if strategic success is to be tied to the performance of individual gurus in the application of their individualistic methodologies because the value added comes from the flexibility and brilliance of the guru rather than the methodology, we are limited in the promulgation of the methodology within a corporation or, indeed, within an industry. The danger here is not that the process described is insufficient *per se*, or that it acts as a catalyst rather than a directing structure, it is that, if mistakenly presented as a solution tool it will appear ineffective.

Soft Systems Methodology

At first glance Soft Systems Methodology (Checkland, 1984), particularly when presented superficially as in (Checkland, 1989), appears as a methodology. Its characteristics are presented as being diagrammatic and structurally based and it has immediate appeal to the user brought up in the domain of engineering, where concepts from cybernetics and analogies from control engineering fall readily to the eye. At this level it has the following stages

- Stage 1 Enter the situation
- Stage 2 Express the problem situation
- Stage 3 Formulate root definitions of relevant systems of purposeful activity
- Stage 4 Build conceptual models of the systems
- Stage 5 Compare models with real world actions
- Stage 6 Define possible changes which are both desirable and feasible
- Stage 7 Take action to improve the problem situation

and recommends consideration of the entities using the following categories:-

Customer

Actors

Transformation process

Weltanschauung

Owner

Environmental constraints

These would appear both reasonable and, equally importantly, good foundations on which to build an adequately complex paradigm (Checkland's 'rich picture').

Checkland does not suffer from the paucity of theoretical foundation of Friend (Systems Choice). His book *Systems Thinking - Systems Practice* (Checkland, 1984) is strong on the philosophical underwriting of the systems practice which he claims was practised from the building of the Great Wall of China onwards. This is not adequate; to present success in complex endeavour as evidence of a particular structure of thought is to confuse effect with result. A road system is not constructed with its final connectivity in mind, it results from the aggregated effect of individual road builders attempting to solve their own

individual problems. And yet if the growth of the road system were to be observed from above over many centuries one would receive the distinct impression that there was a single great intellect at work planning the response of the road system to the needs of wars, the arising of new cities and the invention of new modes of transport.

This however, is merely an observation on the antecedents of the method. Checkland himself makes the point a number of times that the purpose of SSM is to be pragmatic. He refers to the methodology as 'generating structured debate' rather than seeking goals, and it is on this basis that SSM must be judged - does it achieve its results, how, and does its performance need to be enhanced?

The case studies for SSM are convincing in that good development paths emerge from the reported work. The work is seen to be productive and contributory. The method clearly appears to act eutaxiologically, but it should be noted that this is in great measure achieved by the insistence of the facilitator that this should be so. Nothing in the strict methodology prevents the users seeking a direct end result, in spite of Checkland's structural arguments to the contrary. This flexibility, of course, is no demerit.

An interesting gap in the SSM literature is the absence of any taxonomy of structure. Hard system engineering texts are full of structural design examples — feedback, feed-forward, phase advance, Kalman filter, van de Waal's system — the SSM literature generates none of this, and perhaps this is concrete evidence that the method is merely a device for structuring debate, rather than a structure in which to debate.

The philosophical antecedents of the SSM methodology are extensive, drawing on the theological and epistemological theory touched on in the second section of this note, and widening its grasp to take in cybernetics, information theory and the whole of system and control engineering. Does it, however, fulfil the potential of its genes? Nothing in the case history shows the application of information theory, for example, and yet the cost of gathering information of diverse kinds in industry is immense, and the most common constraint on strategic definition or implementation is the absence of information on which

to make those decisions. Wiener's (1949) work on adaptive systems in cybernetics is frequently cited but does not appear to emerge into practice.

It is in this practical neglect of the potential of this rich heritage that SSM fails, and it is suspected that the advances to be made are in the mobilisation of some of the underlying harder methods within an SSM structure. In terms of the issues of Table 4, SSM appears to have every attribute except for the ability to depth-change. It could of course be that the user of the method has a set of behavioural rules for himself when in contact with the client that ensure that these attributes are satisfied. Once again one is left unsure whether the value-added comes from the methodology or the guru.

Meta-methodologies

The last section referred to the Checkland SSM methodology as a methodology 'only at first glance'. The same is true of a number of the methods reviewed here.

It is easy to condemn these methods to one degree or another for their lack of structure, for their failure to declare their terms adequately or for their potential to provide a smoke screen behind which a talented facilitator can perform. In each and every case the accusation can be brought either that the methods are rigorous but limited (game theory, hypergames) or that they are flexible and arbitrary (metagames, SSM, Strategic Choice). Indeed, the position of each method along this single axis is almost a metric for its hardness or softness. To do so, however would be largely to miss the point.

SSM for example, is both a methodology (containing a set of methods) and a structure which sits above the level of methodology. Like the evolution of Rosenhead's attributes and the examination of goal-seeking behaviour above it is an exercise in meta-methodology). Such a distinction can be applied to all the methods and methodologies discussed. Game theory can be represented as a set of theorems of limited use which, if it finds a suitable problem can provide a deceptively accurate answer; but it can also be presented as a structural tool which conditions the analyst to attempt the expression of options in a disciplined and

ordered way. It is meta-methodological in the sense that it is sensitive to the value of the choice to the protagonists and the inherent interaction of their choices one to the other in a way that such sensitivity can be carried over into other methodologies, such as SSM or metagames. Equally, hypergame theory can be considered merely as a set of approaches to conflict problems where the objectives of the players differ and as such is subject to the criticism of limited applicability. It can also be considered, however, from the meta-methodological point view, in which arena it provokes a need to require methodologies to be sensitive to the conflicts of weltanschauung and objective among the protagonists.

It should be noted that uniquely among the methodologies studied, it is SSM which comes closest to the concept of meta-methodology; it is only in its embodiment that it gravitates to earning its daily bread as a methodology. In comparison with other approaches, detailed, below, however, it appears inefficient in its style of argument from the general to specific.

Game theory approaches to conflict

Developed by von Neumann and Morgenstern (1944) in the 1930s and 40s, classical game theory approaches the conflict situations of economics by expressing the choices available to a restricted number of players in either a decision tree (games in extensive form) or in a matrix of options for each player the elements of which contain the pay-offs which would accrue to each if the particular combinations of choices were to be made (games in normal form).

In the case of two player games where the total benefit to be gained by playing the game is unchanging (zero- or constant-sum games) a solution always exists, but it is almost always of the mixed strategy form. This type of solution involves the player engaging a random number generator in order to select, on each play of the game, an option in such a way that the opponent cannot guess what specific choice will be made. The solution to the game consists of the vector of probabilities associated with each choice. This presents an immediate problem. Many of the most important business situations are not repeated. The

teaming decision on a major defence contract does not appear again and again, as in some parlour game. Hence the concept of a mixed solution is rendered questionable, or at least indigestible, in practice. All is not lost, however, since some aspects of major business decisions are repeated to some extent. This is particularly so in oligopoly or oligopsony markets, where the buyers and sellers keep meeting one another and, although the specific decisions are different there is a strong degree of historic judgement applied to the successive plays of the extended game. The iterated Prisoner's Dilemma, discussed below, is relevant, as is the extensive literature on behavioural psychology.

One positive aspect of the early game theory is its very simplicity. A game in extensive form with its information sets marking the knowledge held by each player of the others choices is highly intuitive and falls naturally into the hands of strategists attempting an exhaustive elucidation of a conflict situation.

Regrettably, however, in practice even the simplest games fall short via two mechanisms. First, the practicalities of expressing the competitors' options in such a way that they are mutually exclusive means that a large number of options emerge even in the most simple of cases. Any simplification renders the solution dubious, since there is no characteristic of 'forgiveness' in the sense above in classical game theory. Certainly few of the characteristics deemed desirable above are not present in classical game theory; it is almost the archetype of the 'hard' OR approach. To a degree it is anthropic in that the options expressed emerge from a consideration of the human players involved, but it is suitable only for the most stark and pedagogic examination of strategic decision making.

Classical game theory deals with noncooperative behaviour on the part of the players. They simply activate their random number generators and act in order to maximise their own returns at the expense of the opponent. The next development in game theoretic terms was to consider cooperative games and to extend the noncooperative theory to games where the total payoff to all players was not constant. This latter relaxation is a very important approach to reality, since the behaviour of noncooperative competitors can frequently lead

to a reduction in their collective benefit. Bennett, Cropper and Huxham (in Rosenhead, 1989) describe a striking example in the area of planning development.

This development into cooperative behaviour and non-zero-sum games leads to the important mathematics of coalition theory and of games in characteristic function form. In this form of game the players can agree to form coalitions; the total payoff to the coalition is the sum of the pay-offs to the players, but of course they can improve over their individual positions because they are not in competition and so can coordinate their play. Associated with the coalitions, not surprisingly, is the concept of an imputation, which is the mathematical embodiment of sharing the spoils after a successful team approach. In practical terms we can imagine this as the result of a work-sharing negotiation.

Lastly we should be aware of the very extensive and well-recognised work carried out by Nash (1950, 1951, 1953) and Harsanyi (1977) in the modelling of negotiation. The Nash approach starts a negotiation between two competitors at the point for each of them which is the best under the assumption that they do not, in fact, cooperate. It is in a sense the 'safety net': 'If I play correctly I will gain this amount in spite of my opponent's intransigence'. From this pessimistic point a set of feasible bargaining positions (known as a Pareto-optimal set) can be defined and Nash then assumes that the negotiators recognise that cooperation will move them both to a better position. He imagines that each will accept that the product of each of their gains over and above the start point will be collectively most desirable. He thus maximises $(u - u^*)(v - v^*)$ where (u^*, v^*) is the start position and (u, v) is the maximising position.

The literature on the subject is huge (Rasmusen, 1989; Gibbons, 1992; Morris, 1992; Fudenberg and Tirole, 1993; Heap and Varoufakis, 1995) even for the discrete games discussed above. The literature for continuous games which cover, for example timing issues in negotiation and allocation problems such as financing decisions in market penetration, is even greater.

In the specific field of IR, one can select as a typical source, Brams and Kilgour's (1988) presentation of a generalised conflict game based upon a generalisation of the Prisoner's Dilemma which they subsequently use as a basis for the modelling of the politico-dynamics of the SDI (Star Wars) initiative and for a generalised discussion on the threat process and deterrence in IR situations. The difficulty here is that whereas the solutions are clearly reasonable and, to a degree provide insight into the general behaviour of participants, they remain at the general level of representation. Earlier Boulding (1962), began the development of a dynamic theory of conflict representation based on a type of vector field theory, the strategy seeking process one of optimum seeking over a field of utility functions. The work is related to the Isaacs (1965) studies of differential games and to the work of Richardson (1956, 1960) and Rapoport (1957). Recent developments build upon these earlier continuous models of attrition (Richardson, 1956; Protopopescu, Santoro and Dockery, 1989a, 1989b; Nicholson, 1992; Gass, 1994; Dockery and Woodcock, 1994; Gass, 1997a, 1997b). The main criticism of these conflict dynamics approaches is that the action space of participants in strategic situations is rarely seen as continuous. More often, as is described by Guetzkow (in Chestnut, 1986, p36), the future is seen as a set of discrete states representing possible futures. This is clearly related to the work of Washburn (1990) on directed graph games and will form an important theme of the methods described in the next chapters. Boulding's (1960, p53) view of game theory as essentially a state space problem is useful, however, as a unifying principle. It is also observed that his notes on the difference between the strategic game and a more closely resolved 'local game' (ibid. p39-40) provide a useful basis for progress. Additionally, Boulding's observations (ibid., p35) on the 'misunderstanding processes' mirrored by Bacharach (1993) in the latter's later work on games with differing belief spaces is a long range insight into the instabilities induced in game situations where the participants see the game itself differently.

There are many texts dealing with game theory as a topic within economics, but few which deal practically with the implications of game theory to management. One of these is MacMillan (1992). It presents the ubiquitous simple guide to game theoretic concepts and

then offers analyses of bargaining problems, contract design, executives' pay structuring and a number of other practical management problems, using the concepts of game theory. The situations addressed are essentially two-player games, and result in analyses which are clearly of assistance in a general sense in understanding the way on which negotiators, for example, will establish focal points for bargaining and negotiating spaces by consideration of the values of negotiated assets to themselves and the other party. The analyses fail, however as a basis for strategic conflict management primarily because of the lack of transferability to the complex strategic situations to be expected in industrial conflict situations. Once again we find that the game-theoretic methods provide good specific solutions and good generalised understanding but the specific solutions are insufficiently transferable, while the global understanding is insufficiently specific. Rasmusen (1989), Gibbons (1992), Fudenberg and Tirole (1993) and Heap & Varoufakis (1995) all provide a wealth of specific solutions and are all subject to similar criticism as far as the transferability of their results are concerned.

Incisive as Boulding's observations (1962) are, in general, there are distinct difficulties with game theory as summarised by two observations by Shubik (1983) on the breadth of acceptability of solution concepts. *'Unfortunately the concept of a solution ... for non-zero-sum games is not agreed upon. The Nash equilibrium, frequently used is subject to considerable proliferation, does not in general give a unique value and must be interpreted with great care.'* (Shubik, 1983, p vii) *'... even if we have a full description of "the game" we have to make an inductive leap based upon our social perceptions as to what we wish to consider to be a solution.'* (1983, p12)

In spite of Aumann and Hart's (1992) optimism, *'Game Theory may be viewed as a sort of umbrella or 'unified field theory' for the rational side of social science... it does not use different, ad hoc constructs... it develops methodologies that apply in principle to all interactive situations'*, Shubik (1983, p12) offers a general observation on game theory's applicability. *'There should be some universally acceptable way of resolving the conflicting*

goal problem which takes into account both the realities of power and the concepts of equity and efficiency. Eventually this philosopher's stone may be found, but in the current state of strategic analysis and of game theory there does not appear to be a uniquely agreed upon set of assumptions concerning intent or behaviour but there are many different solution concepts and a patchwork of partial theories which have been more or less justified in certain usages.' This neatly summarises the partial nature of the game theory approach. It consists of a wide set of elegant solutions to particular problems which have little general applicability. Hargreaves, Heap and Varoufakis (1995, p2) are even more dismissive, '*Game theory does not actually deliver*'. Each new problem has to be solved afresh. This is not adequate as the basis of a toolset for strategic conflict management, but it will certainly provide the basis for individual tools within that set. In terms of an adequate contribution to the strategic process described above, these later developments have something to offer. They are richly documented and very well-founded mathematically; they exhibit data-improving behaviour; they are anthropic. On the other hand they are limited in application, highly teleological, procedural, work at a single depth and are unforgiving in the sense of table 4 (requirement 7). As Shubik remarks (1983, p25) '*The formal methods of game theory do not distinguish between tactics and strategy.*' Game theory is very distinctively teleological, '*[r]ationality is cast in a means-ends framework with the task of selecting the most appropriate means for achieving certain ends.*' (Heap and Varoufakis, 1995, p5) It must be said, however, that in the hands of an expert such as Rasmusen (1989) the results are appealing, believable and contributory to the type of conflict analysis to be expected in strategic decision making.

A promising byway in this field is that of the automatic game player which, for an insoluble game such as chess, can provide solutions (or at least sequences of good plays) without having to act in an end-seeking teleological fashion. Out of the morass of methods designed to calculate the solutions for real games has emerged a body of work which establishes criteria of goodness for the state of play in any particular game situation and then, by a recursive method recommends appropriate good moves from that point on (Morris, 1992).

This is a promising style of solution, but one which may yet fall by the wayside because of the need to establish, at the very least, a structure to the game which may not be feasible in practice.

Game theory is also criticised by Heap and Varoufakis (1995, p30) with the observation that '*To be specific, game theory accepts the strict separation of action from structure.*' It is clear in the practical words of both IR and business, that it is inappropriate to hold that participants fix their actions on the basis of a structure which then remains the same for the remainder of the conflict. More likely is that the structure of the conflict is determined both by what the participants see *a priori* as their tactical options and, in a recursive fashion, by an expanded set of possible actions resulting from considerations of the objectives of the players. In other words the structure conditions the tactical choice set as much as the tactical options determine the structure. In neither case is either fixed for the game, since the game is determined by the perceptions of the participants.

In summary, game theory is an essential underwriting of much of the conflict analysis of the twentieth century. It is of itself unlikely to provide more than a simplified view of a highly stylised situation. Game theory fulfils hardly any of the criteria established in the first section by virtue of its inflexibility, inability to change depth and teleological behaviour. As a potential lower level module for specific purposes and situations, however, it more than justifies its presence in any critical review of the subject.

Non-game-theoretic conflict analysis

While the analysis of conflict is centred on game theory, there have been and remain other approaches, mostly of a system analysis or control theoretic descriptive type. Kopacek and Breitenacker (in Chestnut, 1986, pp63-70) indicate approaches based on ideological analysis, macroeconomics and on a 'power approach'. They present a state-space control theory of international stability which is convincing but general in nature. The variables in the model are a mixture of economic variable such as *defence resources* and more subjective

ones such as *threat* and *pressure for reform*. While the behaviour of the model reported is convincing it remains at the symptomatic level, neither giving a universal solution nor an adequately specific one for conflict prediction. This is typical of a series of largely undeveloped approaches which attempt to provide a high level generally applicable model of international conflict behaviour. Other examples can be found in Tu (1983, 1986) and in Onishi (1986), a dynamic soft systems approach to a similar problem, with the special characteristics that it is an attempt at a global early warning system for conflict. Van der Merwe (in Sandole and van der Merwe, 1993, p289) makes a strong argument for the paucity of the static models so prevalent in IR analysis '*... evolutionary analyses of conflict dynamics also need to be incorporated into the models previously examined.*'

Variable Universe Games

A useful set of concepts to deal with the difficulties which arise when players have not just different pay-offs for given terminal states, but where the players have different knowledge of characteristics of the game space. These are described as engendering different *belief sets*. An example (from (Bacharach, 1993) best serves to explain.

There is a well-known puzzle known as *Rendezvous*. Imagine that you have arranged to meet someone in a strange city, say Cardiff. You know that you are to meet your friend at, say 2 pm., but unfortunately you have forgotten to agree on a place to meet. You cannot now contact your friend, of course, because she too is in Cardiff experiencing the same dilemma. What do you do?

Many people decide on a place such as the main post office, or the main railway station, or the Town Hall, and when played as a party game that is usually a winning strategy if neither player knows Cardiff. Problems arise, however, when one player knows the locale and another doesn't. For example, I might know that a very prominent building in Cardiff is the National Museum, and would probably decide on that as my best bet to meet you. If you know Cardiff to the same extent

you may well also alight upon the striking museum columns as a good place to meet. We would 'win' the game by using our common knowledge of prominent buildings in Cardiff. Information has, in fact, been added to our game solution.

But what if one of us knows Cardiff and the other does not? The knowledgeable participant may choose the museum steps while the less knowledgeable would choose somewhere more generally known, such as the railway station. They would not meet. What has happened is that a level of information has not been used correctly, namely that the more knowledgeable participant could have used the knowledge that his partner did not know Cardiff as an indicator that she would not choose the museum for a rendezvous, since it is likely that only the cognoscenti would pick it.

The key concept here is that of the belief set of each player. In the first (equal and poor knowledge) case, both participants have a limited belief set, namely the obvious public buildings. In the second case (both knowing Cardiff well), each includes the museum in the set of possibilities and the outcome is highly favourable. The difficulty in the third asymmetrical case is that the more knowledgeable has to adjust his set of feasible options because he should have realised that the belief set of the other party could not include the museum as a feasible option, and that the other party could only assume that he in turn would have a belief set which excluded the museum (since how could she have known that it could be included in the set of options when she did not know of its existence).

Bacharach (1993) gives an example of a game he calls *Block Marking*. In it two players are shown a box containing twenty children's blocks. The object of the game is for two players independently and without knowledge to mark the same block. If they succeed they win £10 each. If they pick different blocks they win nothing. One can imagine that the bottom of one block is secretly marked by the first player, who then leaves the room while the second chooses. It will be easily seen that the game has a clear connection with *Rendezvous*.

Bacharach gives three versions. In the first (VUG1) there are twenty red blocks all identical. In the second (VUG2) there are nineteen yellow blocks, all identical, and one red block. In VUG3 there are 2 red (identical) and eighteen yellow, identical except that careful inspection reveals that one of the yellow blocks has a slight curvature of the grain.

In VUG1 the obvious tactic is to choose completely at random. There is no reason to suppose that any other rational person would do differently. In VUG2, however, the rational person would choose the single red block, and a win would undoubtedly result. In VUG3, however, we have a similar dilemma as that which arose from the asymmetry of information in Rendezvous. Should the first player pick the unique, but subtly distinguished grainy yellow block, or should he choose one of the two reds, with a 50/50 chance of success? Intuitively one makes a balance between the probability that the other player will be perceptive enough to see the grain in the unique yellow block as against the possibility that she will not.

Bacharach starts from the premiss that a player cannot have a strategy about a situation which cannot be conceived of (or believed in). In this way the belief space, being the set of all things which the player can conceive of defines not only the playing space of the game in terms of its topology or connectedness, but also specifies the actions which can be conceived, since if I have no knowledge of a possible state of affairs, I can have no concept of what to do there. This in turn restricts my belief space about my opponent's belief space, and in turn my conception of what is allowed as an action in any circumstance. Note that this is a much stronger concept than von Neumann and Morgenstern's (1944) information set reported in many texts (Luce and Raiffa, 1957; Rasmusen 1989; Fudenberg and Tirole, 1993).

Deterministic Graphical Games

Deterministic Graphical (DG) games were introduced by Washburn (1990) in order to expand the traditional concept of game trees (games in extended form) to encompass re-

entries into information sets, a capacity which is strictly forbidden in the normal case. Such games take place on a directed graph, with defined nodes and transitions from node to node. Such games may cycle and return to a node or nodes and may be unending. Washburn's concept was to have pay-offs which are made at terminal nodes, while unending games have a zero payoff for all players. These are now known as DGT games (DG terminal games). Alpern (1993) has extended the payoff concept to include pay-offs where the payoff vector for players is (time) averaged over the path followed. Alpern (ibid.) also describes stationary equilibriums for such DGA (DG games with time averaged pay-offs).

Both these games are based on perfect information, a luxury in which the present approach cannot afford to indulge. Nevertheless, the basic theory may provide some insights into the structure and stability of DG games. As in stochastic theory we distinguish between markovian strategies (here called stationary strategies) which depend only on the present state of the game, and non-markovian strategies which have a memory of the history of the development of the game. It may seem at first glance that only the second type are admissible in any convergence towards real life, but this is not necessarily so. It may be possible to redefine the topology of the game to encompass each evolution of the state as a new state *per se*.

DGT games have been discussed by Washburn (1990) in the two-person zero-sum setting. He exhibited an algorithm for finding an optimal pair of pure strategies in polynomial time. Everette (1957) has proven that a solution value exists and an improved algorithm for determining the solution strategies was given by Baston and Bostock (1990). The observations made by Boulding (1962, pp41-57), while being rudimentary in comparison with the later work of Washburn, has striking connections with both it, and the metagame analyses of Fraser and Hipel (1984) and Howard (1971). Brams (1994) also presents a view of a matrix game as directed graph, in that the individual players have control over the moves between potential outcomes. The outcomes are defined as locations in a network, and the powers of the players are available to invoke moves in so far as they are motivated

so to do. Figure 5 illustrates the approach of Boulding.

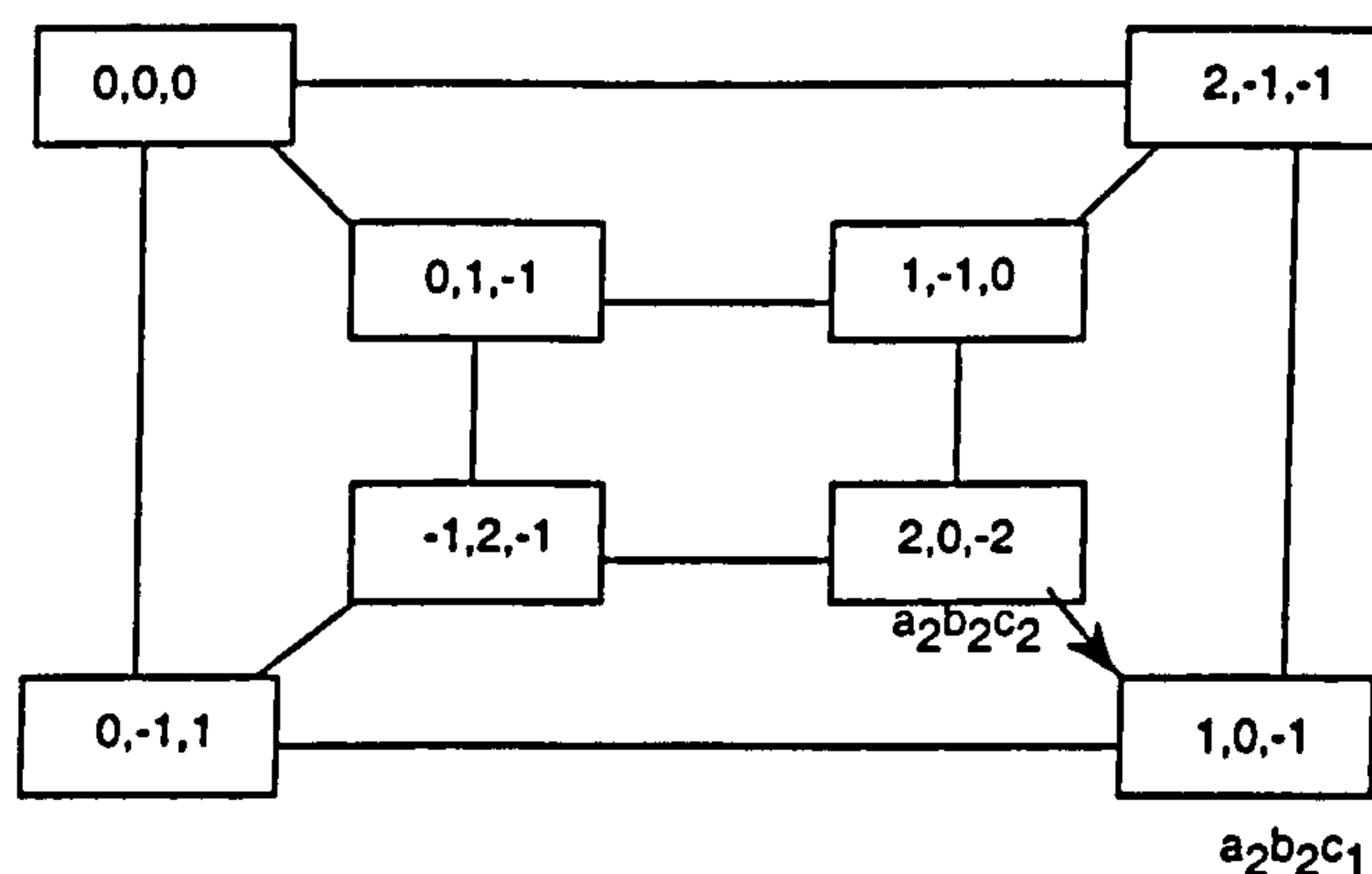


Figure 5 The approach of Boulding to discrete games (Boulding 1962, p54)

In the figure outcomes in order for each of three players, A , B and C are contained in the rectangles and the tactical choices leading to those outcomes are thus, $a_2b_2c_1$. In the bottom right hand corner two outcomes and their associated tactical choices are shown. It will be seen that the only difference between the tactical choices is in the choice made by C (c_1 vis-à-vis c_2). We say that C has unilateral control over the transition. Since the C -component of the outcomes shows that C prefers the extreme bottom right hand corner outcome (1,0,-1) to the one up and to its left ((2,0,-2)), C will invoke the transition, as indicated by the arrow.

Brams (1983, 1993, 1994), building on Brams and Hessel's (1984) and Hipel, Wang and Fraser's (1988) work, extends this idea and establishes sequences of moves which are in the interests of the relevant players to invoke each transitional step in the sequence. He establishes the wider concept of 'moving power' and its associated concepts of holding power, staying power and threat power which are used to establish likely behaviours in such scenarios as the Suez Crisis and in a series of analyses of Old Testament scenarios. He also establishes (Brams, 1994, pp215-219) a complete taxonomy of 2x2 discrete games.

The motivation for the study of such DGA games appears to be the behaviour of companies under conditions of discount or super-counting (where the discount ratio is greater than 1).

Alpern (1989) discusses an alternative method of calculating behaviour in the Rubinstein (Baston and Bostock, 1990) alternating offer bargaining game, where two companies set prices on alternating days. This is easily seen to be representable as a DG game.

A major drawback to the DGT games is that players must be indifferent to all unending plays. Alpern (1991) has presented an alternative payoff function which allows for a discounting of the different unending pay-offs, by averaging over the paths followed. In particular he has shown that (non-zero-sum) DGA games exist where there are no stationary Nash equilibriums. It can be shown, however that in the general DGA game (where the strategies are non-markovian) pure strategy history-remembering Nash equilibriums always exist. While this is comforting, it is unfortunately unlikely to be applicable to the practical case of any practical strategic conflict structure because of the need for perfect information, and because of the difficulty of establishing a cost function associated with a player's changing his tactical choices. Even if these changes could be costed it is unlikely that a straightforward economic cost would be adequate to represent the complexities of the power issues involved in the tactical choice changes in real life.

Supergames

The discovery or recognition that certain very simple games possess at the same time an essential instability and a power to represent, albeit simplistically, human behaviour has lead to the development of interesting work in supergames. These are iterated versions of the very simplest games, and of these the most famous and relevant is the iterated Prisoner's Dilemma or IPD. Axelrod's (1981, 1984) seminal work on this subject has lead to a burgeoning literature accessible both to social scientists and to management scientists.

Briefly, it concerns the behaviour of individuals who are caused to choose between cooperation with a partner or betrayal of that partner. Characteristically the order of benefit to any player is

You defect - he cooperates with you (DC) best return

You cooperate - he cooperates	(CC)	2nd best
Both defect	(DD)	3rd best
You cooperate he defects	(CD)	worst return.

A casual examination will reveal the instability inherent in the symmetrically desirable CC configuration; any departure by a player will (temporarily) improve his return. The dilemma, of course, is that the same applies to the other player symmetrically, and so the DD position becomes the adopted position where communication between the parties is not allowed.

Axelrod (1984) has simulated the playing of the Prisoner's Dilemma in a computer-based tournament. The results show a striking success for the TIT FOR TAT tactic, whereby the previous choice of the other player is always immediately reflected on the next meeting. There is extensive further literature examining the robustness of this and other tactics (Behr (1981), Axelrod (1980a, 1995) and many others).

While the individual game may be simplistic with respect to human behaviour, there is still much to be gained from the examination of the behaviour of CEO's in iterated situations. We certainly view other major companies with an anthropomorphic eye — GEC is risk-averse ; BAe can never make up its mind ; TCSF is always backing two horses — and these simplified personalizations undoubtedly precondition the decision makers' eventual choices. What the IPD work does not show is the effects of reiterated negotiation and the influence of trust and trustworthiness in conditioning the strategic posture of a corporation. It is not enough to say that the trust or mistrust is expressed only at the CEO level, since, as discussed in Chapter 2 above the strategic intent of an organisation can often be seen to act at a number of organisational levels.

In terms of the criteria of table 4, supergames represent, once again, a partial and sparsely adequate contributor. Their major shortcomings are in the area of their limited scope rather than in any particular shortfall with respect to the criteria. Nevertheless the represent an

important theoretical and experimental structure upon which extensions may be built to represent less stark and strictly repetitive situations.

Hypergames

One of the fundamental shortcomings of conventional game theory is that the protagonists necessarily have a common view of the pay-offs of the game. They may have different pay-offs one from the other, for any particular choice of options, but they each know those pay-offs. Put in another way, the players pursue the same objective. Moreover, because the vast majority of game theory is essentially numerical rather than structural, in that its results are usually expressed as particular algebraic solutions rather than as the geometrical 'domain of action' results of softer methods (but note the apparently forgotten work of Isaacs (1965)), there is held to exist a common transaction variable by which one player's return can be compared with another.

This is often not the case in the practical business situation. It is, for example, difficult to compare on any transaction-variable basis the benefit to companies engaged in a three way struggle for a major project. Company A may wish to win an opportunity in order to fill a predicted cash-flow crisis at some time in the future while company B may wish to cross the entry barrier into an adjacent market and company C may express its strategic implementation in this respect only symptomatically as defensively securing the boundaries of its market. Such disjunctions of objective frequently lead to apparently illogical and therefore unpredictable behaviour on the part of the competitor. Game theory does not help directly with such situations.

The still developing hypergame work of Fraser and Hipel (1984), discussed in more detail below, and of Bowen (1981), Bennett (1986), Bennett, Cropper and Huxham (in Rosenhead, 1989), Rapoport (1965; Bennett, 1980, 1985, 1989) and others represents an encouraging adaptive methodology by which the complex interactions among protagonists can be modelled. Perhaps one of its most attractive characteristics is its depth changing ability (to use the criteria of table 4). It can dive into accurate representations of, for example, the

internal power struggles between divisions of a corporation within the decision making context of a corporation-wide strategy development model. Additionally, it is claimed to be data-pragmatic. Bennett, Cropper and Huxham (1989) claim that *'Having drawn up specific hypergames the technical notions of dominance, stability, and so on are brought to bear in formal analysis proper using matrices, trees or tableaux.'* Thus it represents, so far, the most promising area for development. It is certainly anthropic - its models are flexible, almost arbitrary and give ample opportunity for the expression of idiosyncratic views on the parts of the decision makers; it is thus also data-improving and forgiving.

On the teleology-eutaxiology axis it falls more towards the former, but there are indications that its flexibility of representation allows it to be used by both objective-driven analysts and others. If it has a weakness it is in the interface between the hypergame analysis and the underlying levels of, possibly numerical, analysis. The literature is sparse as far as this depth-changing ability is concerned; most papers restrict themselves to the hypergame level as such, rather than showing its effectiveness in a richer, more realistic scenario.

Metagames

At the technique level metagame analysis (Howard, 1971, 1975, 1987, 1989a, 1989b, 1990, 1993) has two components. First is a representation of a conflict situation (a game) as a list of options for a player together with his choice options (what the classical theory would call strategies). In this respect the metagame is simply an isomorphism of the normal form. A simplification is now applied, using judgmental criteria, as to which combinations of options are possible and which are not. This results in a wholesale simplification of a complex game, and, moreover one which complies fullbloodedly with the anthropic requirement. There is total control by the users of which options are to be included and which are not.

After rank ordering by desirability of outcome, the method presents the scenarios in which the players could find themselves in a highly accessible diagrammatic form. A form of

structural analysis is applied which identifies the 'improvement paths' for each player from one situation to another, together with the sanctions which others could invoke. The method provides a way of representing a range of ill-defined human attributes such as trust, love and anger in a partly convincing style (Howard, 1989b, 1993).

Metagame analysis in comparison with hypergame analysis is a small but significant step towards the heart of the soft systems world. It has, in no small measure, all the attributes required of a soft system methodology in that it allows highly flexible and forgiving use of data, it is anthropic, generates signals indicating inconsistencies in data, and certainly cannot be accused of being teleological. It has the great advantage of presenting its recommendations in a structural rather than a numerical and prescriptive way.

The case studies presented (Howard, 1989a) are well-bounded. One in particular deals with the analysis of the incompatible objectives of parties to a labour dispute, and the method indicates fairly convincingly a hitherto unseen solution, namely that of hiring external staff to fill the gap caused by a strike. This allows the company, now in a position of strength, to assure the rest of the workforce that their striking colleagues will not be dismissed, thus, counter-intuitively, undermining the position of the strikers. The method of resolution would probably have occurred naturally in discussion if a Human Resources manager sufficiently well-read in his own field had been present.

Of itself, of course, such an observation is no basis on which to dismiss the method as insubstantial, and, in fact, it is suspected that there is a body of casework unattached to the academic literature which may be more convincing. One is left with the suspicion, however, that it is the practitioner's expertise as much as the methodology which produces good answers in practice.

For the purposes of the present work, metagame theory offers a tangible contribution, by virtue at least, of its hidden case histories which may reveal a method of transferability and applicability. Even if that were to prove the case, however, we are left with the criticism that metagame theory could not be said to be depth-changing or data-pragmatic. In the

same way that conventional game theory has the deepest structural difficulty in absorbing qualitative and subjective data, metagame theory has clear difficulty in absorbing quantitative inputs.

The extension of Howard's (1971) work by Fraser and Hipel (1979, 1984) (Hipel, Wang and Fraser, 1988) is central to the developments reported here, and will be discussed in somewhat more detail than other methods.

Howard's approach was to identify a conflict as a set of outcomes, or states, which were defined by the choices available to the participants. Each participant has a number of choices which he can adopt as tactics; each opponent has choices which she can adopt. Combinations of choices lead to outcomes, as in a conventional normal form game. Howard's extension was to consider the extent to which payers can move between outcomes (tactical choices) on a unilateral basis. If the difference between two outcomes, i and j derived only from a tactical choice under the control of a single player, P , the change from i to j presents the possibility of unilateral action on the part of P . Howard then makes the observation that if P prefers i to j , he will not induce the transition, whereas if P prefers j to i the transition will be induced by P , and a unilateral improvement, or UI will be induced.

Although best understood from scratch in the above manner, Howard's approach in fact stems from consideration of metagames. *'A metagame is a game that takes into account the possible reactions of a particular player to the other players' known strategies in the basic game.'* (Fraser and Hipel, 1984, p205). Let us (following an example of Fraser and Hipel), consider a US-USSR standoff with each player having the options C, L and S, where C consist of a conventional attack, L consists of limited nuclear action, and S consists of full nuclear release. Outcomes of the game then consist, conventionally, of pairs (x,y) such as (L,C), where the US responds with a limited nuclear strike, L, to a conventional attack, C, by the US.

The situation is not resolved in a single step, however, and metagame theory considers conditional responses on the part of one player to all options on the part of the other player

as if there were a sequentiality in the game. Thus, the US meta-strategy takes the form $a/b/c$ where a is the US response to a Soviet play of C , b is a response to the Soviets' playing L and c is the response to a Soviet play of S . There is a similar meta-strategy $d/e/f$ for the Soviet player, where d, e and f represent choices from the available tactical choice set for the Soviet player.

Moreover, it will be seen that if the meta-strategies are presented in a normal (matrix) form, they constitute a matrix game which is subject to all general solution approaches of such games.

In the example presented, there are 27 possible US combinations. One of them, for example, is LLS , where the US will respond with limited nuclear response in all cases except where it is attacked with a full nuclear release. The outcomes of the game can be calculated and presented in a matrix such as Table 5 below.

		USSR		
		C	L	S
US	$C/C/C$			
	$C/C/L$			
	$C/C/S$			
	$C/L/C$		(U,V)	
	$C/L/L$			
	$C/L/S$			
	$C/S/C$			
	$C/S/L$			
	$C/S/S$			
	etc.			

Table 5: Indicative example of metagame matrix.

Howard (1971) then applies criteria of rationality similar to those of conventional normal form to ensure that players choose options which comply with their stated preferences as to outcomes. The method has the advantage that it allows a player to take into account the contingent nature of strategies in a sequential game, or in a game where sequentiality can be

assumed. The process can be continued, so that meta-meta-strategies are defined where a listing $x/y/z/w/u/v/\dots$ for the US defines the responses to a series of Soviet meta-strategies like $d/e/f$ above.

Howard establishes algorithms for solution or equilibrium seeking. An outcome is *rational* for a player if it is the best outcome that she can obtain given that other players do not change their strategies. An outcome that is rational for all players is called an *equilibrium*.

There are three levels of rationality applicable which Howard defines,

Rationality, where there is no unilateral improvement (UI) available to any player from a state (defined by a choice of meta-strategies on the part of the players).

Symmetric meta-rationality, where, for every UI, another player can act so as to take the game to an outcome which the first player prefers less than the start position.

General meta-rationality, which applies to all the other outcomes (after rationality and symmetric rationality have been found) if there are no inescapable improvement strategies available for the participants. General meta-rationality occurs when a cyclic argument must be applied; whereby a player apparently is sanctioned from a UI by symmetric meta-rationality but then has a counter choice available which in turn is countered by other players, and so on (Fraser and Hipel, 1984, pp 215-218).

These are applied in the following flowchart (Figure 6) to detect stability or equilibrium.

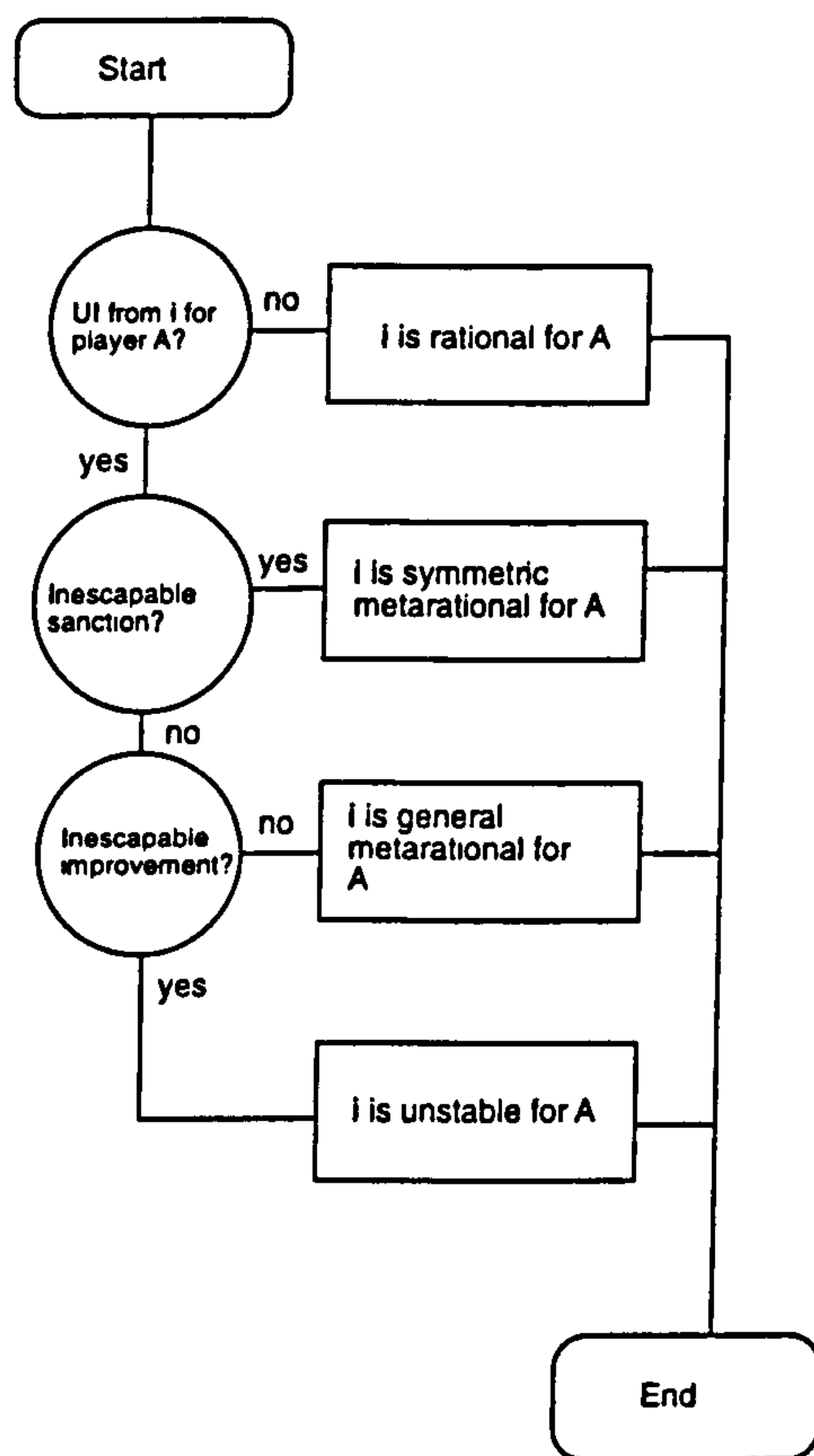


Fig 6: Flowchart (after Howard, 1971), showing the analysis algorithm for determining stability

Fraser and Hipel then extend the Howard method (Fraser and Hipel, 1984, pp223-230) using the following argument. *'[A]n action on the part of a player or players is credible if and only if the action results in an outcome more preferred for the player or players who are levying the action. Thus the only outcomes that could credibly deter a player from improving an outcome are those that can be achieved by the other players improving their position from either the possible UI available to the player, or from the outcome under consideration.'* This leads to the following important extension to the stability concept. Howard conceives of the stability induced by sequential stability, where a UI for a player A, from i to j is sanctioned by any other player, B, if B has a preferred UI from j to another state which A prefers less than i . A's action is sanctioned because another player can subsequently take him to a state he likes even less than his start point. His satisfaction at reaching the preferred state j will be only temporary. Hence he will not invoke his power to

bring about the UI from i to j . Fraser and Hipel then extend this concept from sequential stability to simultaneous stability. Here, the possible improvements from the state i to other states under the control of B are considered, as well as those states which could be accessed by B from state j , the intermediate one. Note, however, that we are still considering only UIs, namely that those transitions where a single player has control over the transition from one possible outcome to another.

Fraser and Hipel then use their revised stability criteria to determine which combinations of outcomes are stable, and hence which are likely to be results of the development of a scenario. They apply this convincingly to a number of simple and complex scenarios, ranging from the Cuban Missile Crisis (ibid., p.53-62), to the complicated Garrison (pp25-49) and Poplar River (pp.160-167) conflicts between the US and Canada over the drainage system policy on their joint border. They also engage in a discussion of a state transition matrix approach which offers the potential of addressing the dynamics of a conflict. States are defined as previously, by the combinations of tactical choices, and the feasibility of moving between them is expressed in a state transition matrix, which can be solved using well known methods.

We can view the work of Fraser and Hipel as carrying out the following procedure, in summary:-

- Define a set of players

- Describe the tactical choices available to each player as a set of bipolar choices (e.g. either **invade** or **not invade**)

- Compile a set of all mutually compatible tactical choices on the parts of the various players. Some combinations of choices of player A will not be compatible with choices for player B. This set of feasible tactical choices then constitutes the playing space of the game. The choices of tactical options constitute a set of states of possible future outcomes.

Determine which transitions between these states are feasible in the sense that a player has both motivation to move from one state to another, and can do so unilaterally because only his tactical choices have to alter in order for the transition to take place.

Apply the developed stability rules to determine the equilibrium outcomes.

We can thus see the Fraser and Hipel and Howard methods as discrete state space approaches to games. This perspective then links them intellectually with

- a) the DGGs of Washburn (1990)
- b) Theory of Moves of Brams (1994)
- c) The game theoretic representations of Boulding (1962, pp49-58)
- d) The multi-futures work of Rhyne (See below)

and these connections will be expanded in Section IV, chapter 5, as a new framework is presented for discussion.

Shortcomings of Howard and Fraser and Hipel Approaches

Before offering a critique of the two styles of approach together, we observe the comments of Fraser and Hipel upon Howard's (1971) approach, (Fraser and Hipel 1984, p.223)

' Although the metagame analysis method of Howard (1971) discussed... provided one of the first approaches for the rigorous study of a complex conflict situation, it has a number of flaws that render it difficult to use in practice:

1. Metagame analysis requires a large number of tables. In a thorough analysis each player requires a separate table for each outcome. Thus the total number of table is the number of players multiplied by the number of outcomes in the game...

2. Metagame analysis merely determines the metaequilibriums in a game. It is up to the analyst to distinguish the outcomes that are based on credible sanctions and that

thus might be resolutions to the conflict. Since often most of the outcomes in a given conflict form metaequilibriums, the metagame analysis does not really provide much information other than a convenient notation.

3. *Metagame analysis cannot readily be used for the analysis of games in which information is incomplete or misleading.*

4. *Metagame analysis is not easy to computerise, although efforts have been made to do so.'*

We note here the nature of Fraser and Hipel's critique; it is based on an assumption (point 2 above) that the analysis method should secure a solution which does not draw upon extrinsic knowledge. A distinction is being drawn here between intrinsic knowledge, being that information which is comprehended formally by the model of the game and, on the other hand, extrinsic information which is a body of knowledge germane to the problem which is undeclared at the commencement of the solution procedure but which may subsequently appear to be relevant. Clearly the aim of a formal mathematical solution must be to achieve rationality over and above that of plausibility by restricting argument to the intrinsic information, being the only body of knowledge declared *a priori*. The contention in this present work, however, is that to act under such a limited definition of rationality is to deny access to a body of knowledge which is germane but undeclared. The price then paid is that of an apparent weakening of the logical chain from *a priori* assumption to conclusion, but if this linking is achieved without accessing a piece of information which is extrinsic and therefore not formally included, the conclusion will be less strong than if both intrinsic and extrinsic information were to be comprehended as they are perceived to be necessary in the solution procedure. The difference in approach derives essentially from a distinction between a proof and a normative-descriptive management tool. Moreover, there is an assumption that the conflict resolution process should be (indeed has the potential to be) rigorous. Both of these assumptions (invalidity of extrinsic knowledge and rigour) are rejected here as inappropriate save for the examination of stereotypical game theory

situations as distinct from the rich and woolly situations of real-life business strategic conflict.

The following difficulties are observed in applying the two methods, of Fraser and Hipel and of Howard, in the business strategic application in particular.

a) Paucity of tactical representations

Both existing methods represent tactical choices as a set of two-way choices. In reality tactical choices are (or can be) much richer. For example, in a bidding struggle the choice of bid price can be represented as a set of bipolar choices, but is more effectively represented as either a choice on a continuum or among a large set of breakpoint prices. This bipolar tactical choice set is something of an encumbrance, since it tends to exacerbate the combinatorial problem of the growth of the number of tactical 'words' in the tactical game-space. A multipolar tactical choice representation is more efficient in this respect.

More generally, the representation of tactical choices as bipolar 1/0 options does not encourage imaginative tactical examination. One of the difficulties in the strategic process is that the opponent can only be imbued with objectives or assumptions of which one has conceived. *See also* (Bacharach, 1993, pp 259, 258). The limited tactical representation does not appear to help with the necessary expansion of the sense-maker's belief-space.

b) Order of analysis

Both the conventional methods start with an examination of the tactics and end with statements about the likely outcomes. Figure 7 illustrates this.

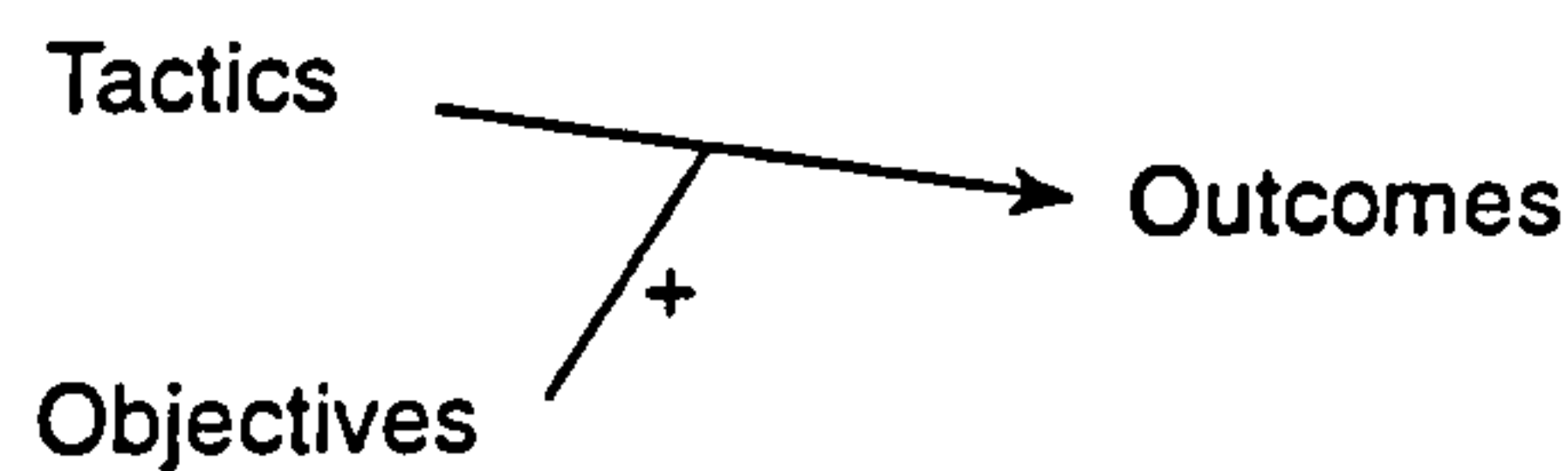


Figure 7: Order of analysis in Fraser and Hipel approach

This is not an unreasonable position; tactics, after all, determine outcomes. Many other things determine the outcome as well, however, and there is an implicit assumption in both approaches that if only the tactics of the players were defined (in terms of the choices they have made to induce an outcome) then an outcome can be defined. This is patently not the case, since a plethora of environmental factors which surround the model will also determine the outcome, to the extent that the game is an imperfect sampling of the rich real world problem. A more appropriate approach stems from the recognition that it is the outcomes which are important to players, and it is towards these outcomes that they will drive their actions. Figure 8 shows a structure which allows the accommodation of structural factors (states or outcomes), objectives and tactics to contribute to the perceived conflict structure.

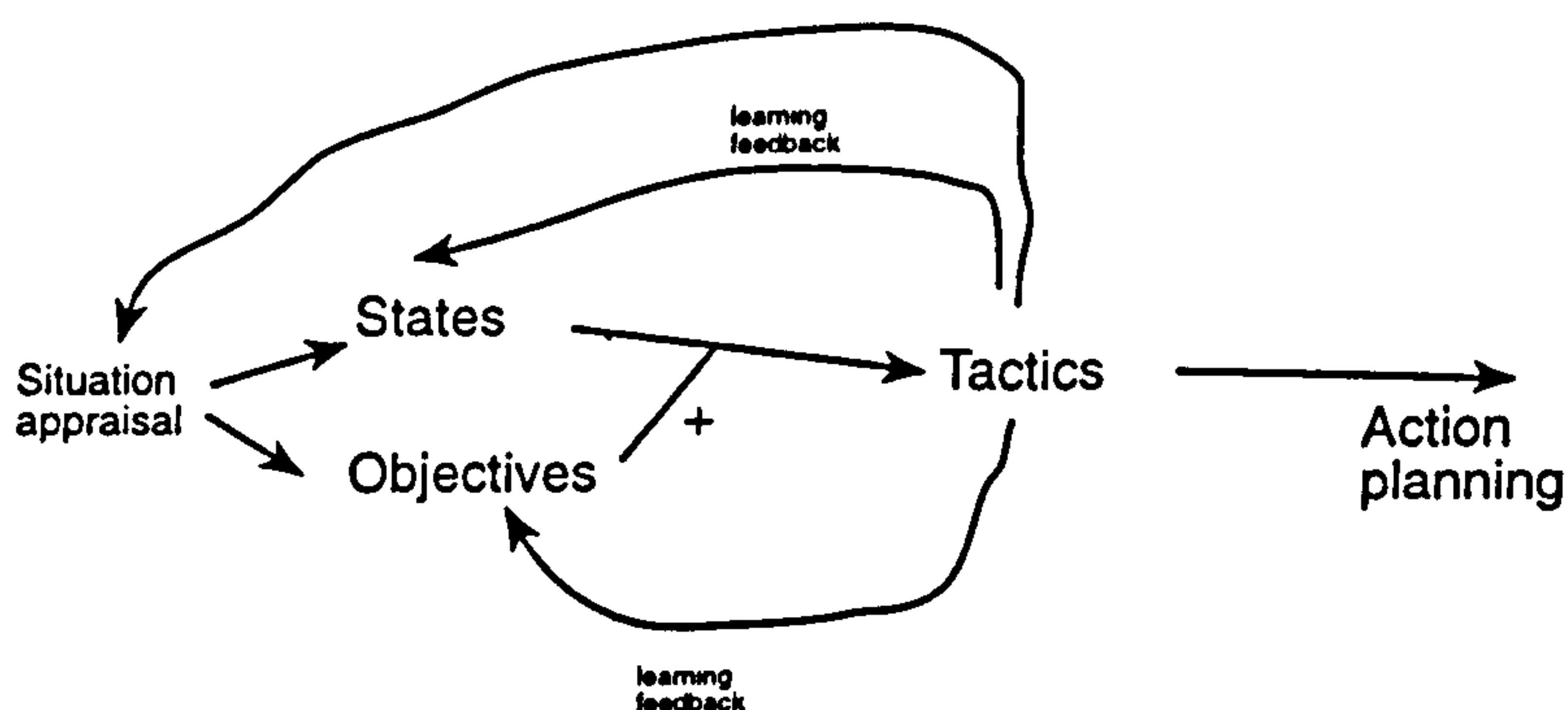


Figure 8: Sensemaking and action planning structure

Thus, it is the outcomes which determine the tactics as well as the reverse. Clearly,

however, the two interact inextricably. In determining one's freedom of action in a situation it seems more natural to enquire what is the desired outcome, and then to move to a discussion of what options are open to the participants. The Fraser and Hipel approach is not unreasonable, taking as it does the assumption that in a well-defined model the outcomes will be determined by what the players choose to do, but it is likely to lead to a poorer view of the tactical freedom, since it moves *ab initio* to the tactical choices, rather than letting the likely actions of participants emerge from what they want. Fraser and Hipel are fatalistic, in a sense, in that they implicitly define the outcome as what is resultant from the effect of a choice of tactics among a set necessarily limited by being *a priori*. To put it another way, they only admit into the players' belief space those outcomes which result from a tactical choice, rather than admitting what is desired, even if, at first glance, the outcomes may appear unreachable. Moreover the alternative sensemaking/planning context (Figure 8) indicates that because of the order of assumptions and analysis, the output of the process is something which is controllable, namely the tactics, as opposed to something which is only secondarily controllable, namely the outcome. This is a matter of placement of the inventive effort in the planning process. New tactics may be inventable as a result of a recognition that what is desired is unachievable with the existing conception of tactics. In the conventional approach, the output is a set of outcomes which in reality are consequences of tactics and objectives and are therefore only susceptible to the inventive spark at second hand.

c) Treatment of observed system

The difficulty here is one common to all models which work by observing the system to be represented and then cease observing it while the analysis is being carried out. Most mathematical and logical models are of this type. The activities of the critical modernist philosophical community on the one hand and the soft

OR community on the other, however, admit of a different species of model, where the process of analysis itself is a continual re-examination of the system observed. These models no longer shut the door on the observed system after the initial observation; they continue to comprehend its changing character as the analysis evolves. One can categorise the problem by means of Figures 9 and 10. Figure 9 (from Fraser and Hipel, 1984, p7) shows the approach of the conventional methods. Data is effectively input only at the beginning of the process, so that the analysis must be rerun in order to insert further tranches of data later in the process.

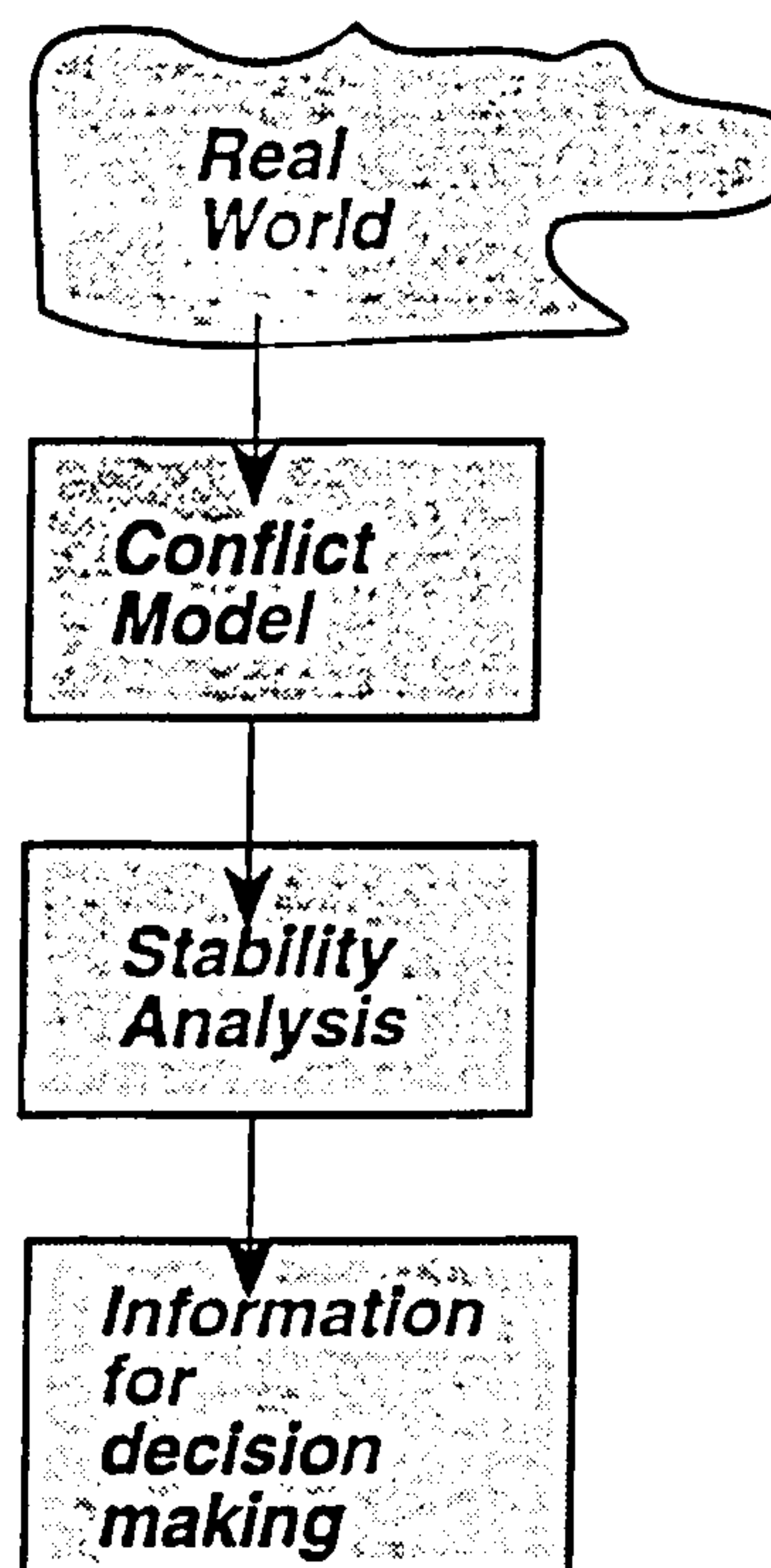


Figure 9: Fraser and Hipel analysis sequence

Figure 10, however illustrates the greater degree of interaction between the analysis process and the observed system more representative of the degree of interaction between action planning and sensemaking observed in strategic decision making (Huff, 1985; Huff and Reger, 1987; Pfeffer, 1981). This is necessary because the process of strategic decision making is not simply one of representing an observed system. Rather, the strategic process is firstly a sensemaking activity (Weeks and

Whimster, 1985; Whittington, 1995) - only then can options be identified and weighed, leading to a resultant action plan. Sensemaking is at the heart of the decision making process. Added to this requirement is the observation that in any strategic problem, the analysis itself alters the observed system. The need for the structure of Figure 10 follows.

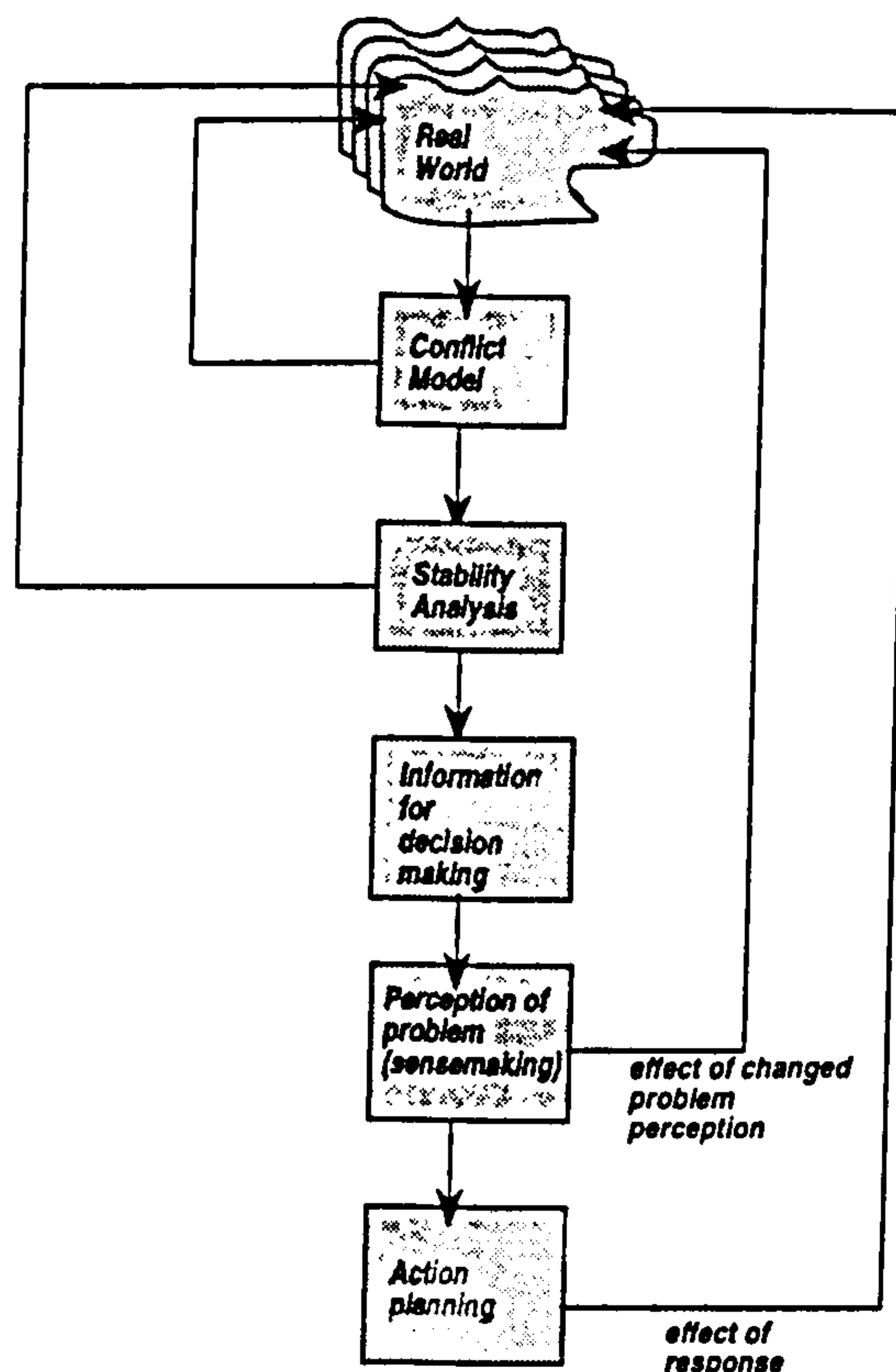


Figure 10: Alternative analysis sequence

Confrontation Analysis and Drama Theory

A recent extension of the metagame work reported above attempts to understand the effect of changing motivations, and utilities by players during the evolution of a game. Drama theory (Howard, Bennett, Bryant and Bradley, 1992; Howard, 1994, 1997a, 1997b) observes that *'the dynamics of conflict are often driven by the paradoxes actors encounter when trying to respond rationally to a situation perceived as fixed.'* (Bennett, 1997, p4). Typically these paradoxes present themselves as sanctions or promises which the actor would be unwilling to carry out. Often these irrationalities of choice are shown up as disjunctions

between a myopic utility preference in conflict with a perceived greater good for the economic context in which the actor sits. The game of Chicken, treated later in some depth is a good example of this, where a player is forced, by a myopic attitude towards utility, to put himself and the other player at personal risk in order to maximise his own gain.

The drama theory approach is to identify the actors, their options and preferences in a frame of reference, the situation as seen by a particular actor.

The drama evolves as a set of episodes. These episodes or scenes, defined by tactical choices made by the actors are expressible in a tree form.

Within each scene there is a classical dramaturgical trajectory of scene-setting, buildup, climax and denouement, this being a microcosm of the drama as a whole.

Each player in each scene adopts a position - a scenario which they would have come about. Communication takes place within these scenes which results in the understanding among the players that they each have incompatibilities between their own positions and those of the other players. This leads to a denouement or climax where the frames themselves come under the pressure of the observed incompatibilities. Stability is reached when the frames are no longer under pressure because all the pressure points have been explored. Drama theory claims to offer a general mathematical treatment of how the frames are transformed from episode to episode. Emotions are interpreted as stemming from irrational choice, where the positions of the players (their perceived frames) are incompatible. A realignment of the frame results, and drama theory claims a mathematical structure to predict this.

The related confrontation analysis (Howard et al, 1992; Howard, 1994, 1997a, 1997b; Bennett, 1997; Bennett and van Heeswijk, 1997) provides suggestions as to how the drama is likely to develop. In particular, a set of topologies is offered which together characterize the possible frame incompatibilities which the players may encounter. An example (Bennett, 1997, p9,10) is the cooperation dilemma; player A is undecided whether he should trust player B because in spite of a promise to cooperate, A sees that B has a myopic self-

interest not to cooperate. Confrontation theory in conjunction with drama theory seeks, then to characterise these stylised positions and to break down the overall drama into episodically treated micro-conflicts. It is well supported by software and has had some practical applications (Bennett and van Heeswijk, 1997).

In the context of this present work, drama theory and its extension suffer from the same disadvantages that hypergames and their extension to confrontation analysis exhibit. In particular, the definition of scenarios (in conflict analysis) or episodes (in drama theory) exclusively by tactical choice is unnecessarily restrictive. Secondly, it would appear that the establishment of the positions of the actors can only be achieved with their cooperation; if communication is not present, as is frequently the case in industrial situations, the observer cannot make any appreciation of the position of the actors. Nevertheless, drama and confrontation theory are seen as useful adjuncts to a more specific solution framework to the problem of planning and managing strategic conflict.

Multiple Futures Planning

Although they are not specifically concerned with the management of conflict, multi-futures planning tools such as Field Anomaly Relaxation (FAR), described below, provide the basis for planning in conflictual situations. A description of FAR is included here in order that its connection with the discrete game approaches described above can be appreciated. It also provides the basis for a link between discrete multi-futures planning and directed graph games later in this work.

Field Anomaly Relaxation (FAR) (Rhyne, 1974, 1980; Coyle & McGlone, 1996; Coyle, and Sutton, 1994) is a future scenario development tool used in military planning. It has been largely ignored in spite of having an ease of use and applicability which at least compares with other futures tools. It has been used in the analysis of scenarios in the SE Asia region, and in at least one other limited analysis for the purposes of critique. Both appeared most promising and FAR received the approval of both sets of commentators in

respect of its potential for the exploration of future scenarios for the purposes of military planning at a national level.

FAR is characterised by the following steps, summarised in Figure 11.

- a) declaration of important, essentially self-contained fields which are aimed at characterising the nature of the future scenarios, the exploration of which is the objective of FAR.
- b) a breakdown of those characterising fields into a scale of effect. For example 'tension' might be scaled into 'peace', 'diplomatic friction', 'sporadic non-firing conflict', 'limited hostility', 'general regional warfare'.
- c) the establishment of a metalanguage which consists of a word, the components of which are the scale values of the fields. These words then span all the possible combinations of fields and scale values. If, as recommended by Rhyne, there are around 7 fields and around 7 scale values there will be about 800,000 possible words. This is large, but not excessive; any smaller and the scenario possibilities will be insufficiently rich; any larger and the work content of any analysis explodes. Nevertheless steps must be taken to reduce this number of possibilities to allow progress towards a usable set of scenario possibilities.
- d) the pairwise comparison of elements of each vector-word to ensure that each vector-word word is internally self consistent. It is understood that this reduces substantially the number of feasible scenarios
- e) a whole word self-consistency examination. This reduces the number of feasible words, typically to around 100 - 200 possible futures.
- f) a grouping process (clustering) to allow the analysts to deal with a number of scenarios having similarities as a group. Additionally, of course, the substantial reduction in scenarios at this stage makes it significantly easier to hold the nature of the scenario group in the mind at one time.

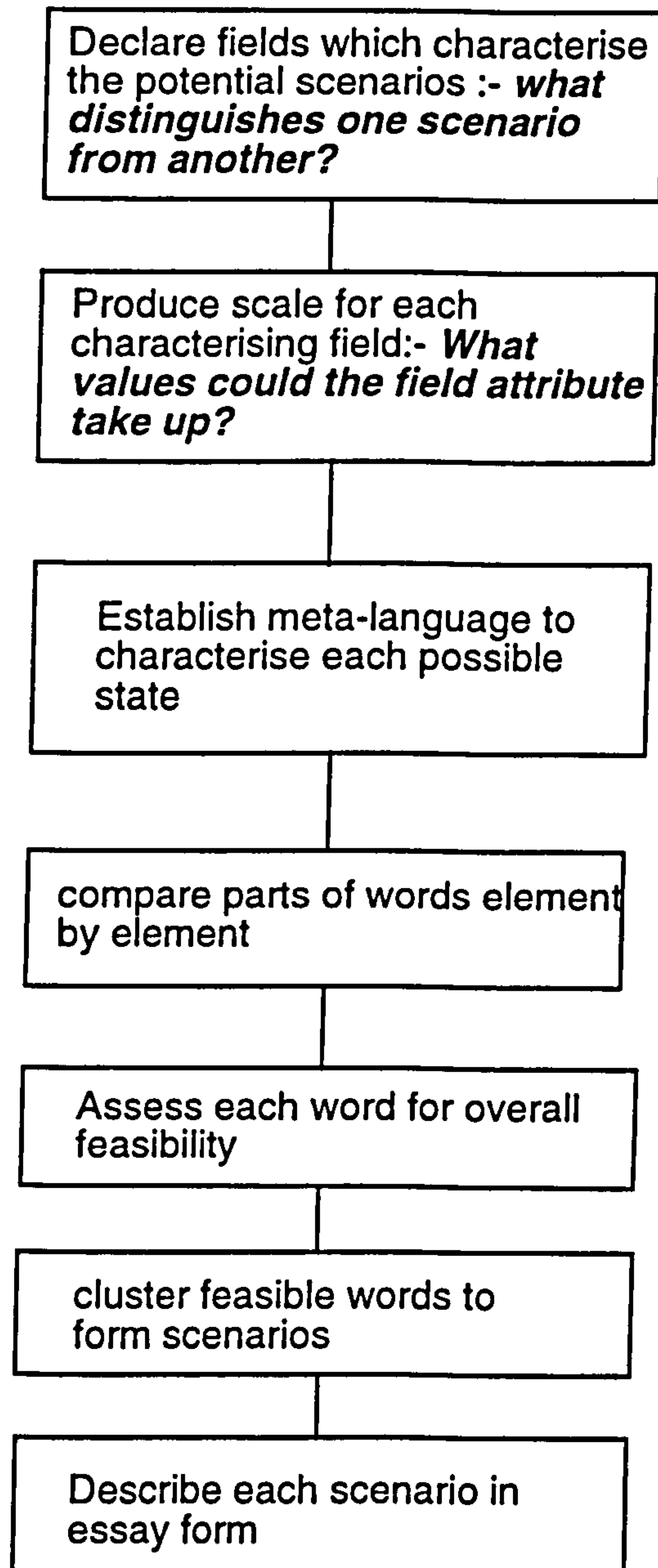


Figure 11: General procedure for field anomaly relaxation

- g) description of the members of this reduced set of states (words) in essay form, to bring them to life in the sense of testing their consistency and reasonableness against the world models of the analysts
- h) generating a tree structure (Figure 12) which illustrates the potential development from one scenario to another, together with a time-line.

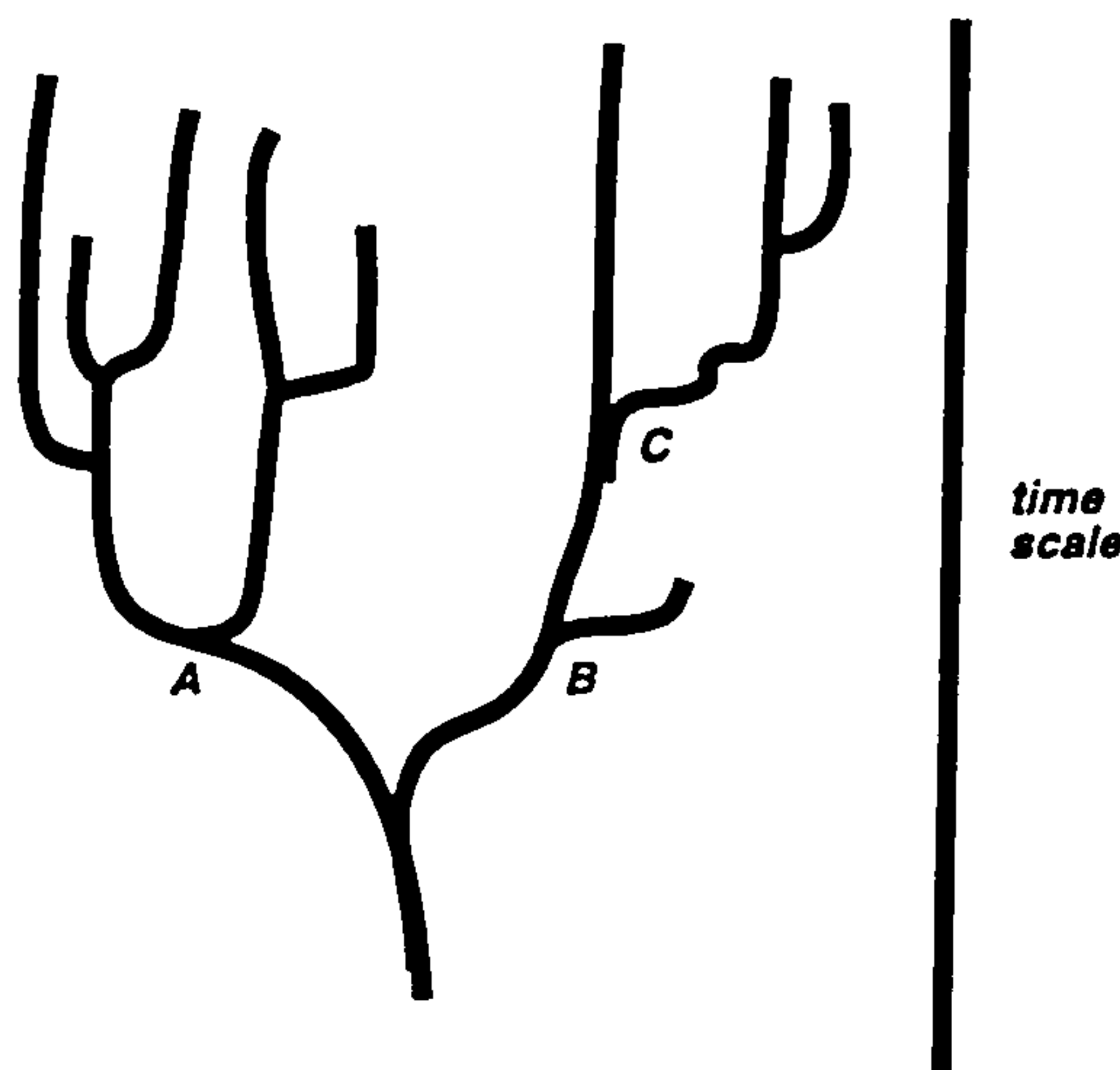


Figure 12: Futures tree generated by FAR. Each node represents a clustered set of futures.

This tree structure can be thought of as a type of directed graph where locations (nodes) are produced by the FAR filtering process. These nodes can also be considered potentially as the outcomes of a complex game where the tactical choices of each of the contributors to the futures contribute to the words, and these words form the basis for outcome calculation. In this respect FAR provides potentially a discipline for producing outcomes without explicit description of the players in a scenario.

The work has been extended (Powell & Coyle, 1997) and (Powell, 1997) to make more explicit the directed graph aspect of Rhyne's work. This extension is reported fully below and forms the basis for a supporting technique to the subject of this present work.

Summary of applicability of methods

Table 6 below shows the main criticisms of the techniques addressed in this chapter when compared against the criteria of a strategic conflict management tool derived earlier. It can be seen that no single method covers all the requirements. No prospect appears for any substantial development of either the IR-derived methods not for the general soft systems representation methods such as SSM. In the first case the approaches are too concentrated on the procedures and bases for the conflict. In the case of the System Analysis approaches, while they will undoubtedly provide insight into the context and structure of the conflict situation, they are unlikely to be sufficiently focused on the conflict issues as such.

We shall see below, however, that many of the techniques discussed here form part of a basis for the development of a unifying approach. In particular the following are particularly relevant for the framework proposed:-

Conventional game theory in its multifarious representations is insufficient of itself to provide a wide enough and transferable basis for a general conflict management method. Nevertheless its elegant and specific solutions have the advantage of being robust in a mathematical sense, and should provide elements which fit under a higher level framework.

Variable universe games may provide the foundation for a method which deal with the differing belief spaces of participants.

Directed graph games, in combination with the concepts indicated from metagames will provide one basis for a state based approach which will allow successive focusing on elements of a wide structure - a depth changing approach. What is required is to make more general the basis on which the transitions between states can be allowed. In particular the concept of a unilateral improvement does not reflect the fact that in many practical cases the transition from one 'state of affairs' to another is very definitely not in the hand of one player, and while it would be argued that the state definitions of metagames could be expanded to account for

this, such an adaptation appears to be insensitive to the practicalities of state generation.

Such a directed graph game, informalized to take into account the rich practical environment, may well use a higher level state-based environmental model to set the boundary conditions for the lower level game.

Within such a structure the scenarios or states generated by FAR may well provide an overarching contextual and strategic structure into which more detailed conflict analyses may fit.

A wholesale adaptation of the state generation process common to many conflict analysis methods, namely that the states of nature, the outcomes of the game are defined solely by the tactical choices made the players *a priori* must be undertaken if the framework is to reflect the interaction of sensemaking and action in strategic decision making.

We shall see in Chapter 5 that these elements can be brought together to form a flexible framework which complies with the requirements of Table 4 derived earlier, and which gives effective action planning products for strategic conflict management.

Effectiveness as a strategic conflict tool Effectiveness as method of strategic conflict management		Potential as basis for further development	
	Specificity		Practicality of output
	Conflict resolution	Transferability	
International Relations-derived methods	Non-specific	Not transferable	Procedural advice for negotiation but not usable as a conflict management tool
	Specific to mechanics of conflict	Nil	General support only
	Highly specific if required	Transferable	Not sufficiently directed
Systems Analysis Methods	Non-game theoretic conflict analysis		Too general to provide a procedural basis
	Robustness analysis	Solutions are to specific problems	Possible basis for general method
	Strategic Choice	Solutions are to specific problems	Little prospect as a basis
Game theory	Soft Systems Methodology	Solutions are to specific problems	Too general a methodology
	Conventional Game Theory	Not transferable	A basis for elements of a wider theory, but lack of transferability means that it would have to be fitted into a higher level framework
	Variable universe games	Undeveloped	A conceptual basis for dealing with differing belief spaces. Insufficiently developed and insufficiently flexible to provide a practical basis
Multi-futures	Directed Graph Games	Undeveloped	Very strong basis for a state-based general approach. Outcome representations generally too inflexible. General concept of transition under control of players highly relevant
	Supergames	Not transferable	Not relevant. An appropriate method for studying general effects.
	Hypergames	Not transferable	Not relevant except as a possible basis for coping with differing belief spaces
	Metagames (inc. drama theory)	Some transferability	Good potential for extension by making representation of power more generalised
	FAR	Good transferability	Good potential for high level planning tool. Potentially a structure into which more specific game theoretic game theory-derived solutions may be fitted

Table 6: Summary of potential contributions of existing methods and their potential as part of an overall framework

Section III: Methodological foundations

Chapter 4: Methodology and this research

Aim and objectives

Research paradigms

Justification

criteria

internal

external

method

Intervention inquiry strategy

Overall study methodology

Chapter 4: Methodology and this research

Aim, objectives

In Chapter one the following research aim for this work was declared, and it is reproduced here for the convenience of the reader.

Research Aim:

To provide an appropriate, justified technique for the predictive understanding of strategic conflict.

<i>Research Objectives</i>
1. Examine the nature of strategic conflict
2. Identify desirable characteristics for a method.
3. Assess existing methods against these criteria .
4. Propose a candidate framework.
5. Compare this framework against the criteria of goodness.
6. Develop a particular embodiment of the framework.
7. Test the embodiment in practice. Assess the embodiment against the criteria
8. Make amendments and propose further development to the framework

Table 7: Objectives of this research

Table 7 summarises the objectives leading to the achievement of that aim.

The purpose of this chapter, then, is to report the selection of the methodologies, paradigms and study frameworks appropriate for the achievement of these aims and objec-

tives. It is assumed that, since strategic decision making is carried out by people, individually and in groups, and is effected within a structure, be it industrial or sociopolitical, which comprises groups of people acting in a social order, it is, of essence a legitimate topic for the application of social science research paradigms. At first glance this assumption would appear to reject non-social science paradigms and, in particular, that of the logical positivist scientific traditions, but we shall see below that the latter tradition is fully comprehended (although enthusiastically undermined) by the social science paradigms.

Research paradigms and perspectives

Paradigms of social science research quantitative versus qualitative approaches

John Stuart Mill (1843) was the instigator of a movement towards the quantification of social study in pursuit of the methods of the natural sciences. In an attempt to move forward the study of social systems it appeared appropriate, both for sociopolitical reasons and in a genuine desire to emulate the undoubted success of contemporary 'hard' science, to adopt what were understood as the main tenets of such quantitative approaches. Specifically, the ease with which hypotheses could be verified (positivism) or falsified (post-positivism) was strongly related to the degree of mathematical precision with which the hypothesis could be stated.

A quantitative approach today has enormous attractions to the researcher. Powerful techniques for the gathering of data are readily available; equally, powerful computers are available for their reduction. Moreover the very structure of the mathematical structures which underwrite much of the process of understanding in the 'hard' sciences lends itself to a simplicity of representation which is attractive to the observer/commentator. The expression of a functional relationship between observed variables is efficiently expressed in mathematical form and is thereby easily studied by the quantitative method.

There are, however, significant critiques of the quantitative method in the context of the

social sciences. Guba and Lincoln (1994) divide these into internal or interparadigm critiques and external or extraparadigm critiques. Together they present a strong attack on the previously unchallenged supremacy of the quantitative method.

internal critiques

Context stripping

The quantification and randomisation approaches inherent in the quantitative method strip away, by deliberately suppressing them, those variables which form the context of the study. In a sense, the accepted data gathering, reducing and interpretation methods are accused of presupposing the relevance of variables *a priori* in the experimental designs. Additionally, because of the search for theoretical rigour, the generalizability of such models is effectively limited to the constrained sets of circumstances in which they were discovered.

Exclusion of meaning and purpose

When we consider the activities of humans, either individually or in groups we cannot divorce the behaviour from the intent, meaning and purpose of the subjects. These latter attributes are less amenable to quantitative approaches.

The dilemma of inclusion over distancing

The externalised, outsider (etic) theory brought to bear on the problem may have no relevance to the way of thinking or value systems of the informants. Unlike the qualitative approaches the quantitative are ungrounded in the belief spaces of the informants. An emic, insider view which includes the researcher within the participants' belief structure is essentially qualitative in nature and provides the possibility of determining the belief structures from within. For strategic research this is a most serious criticism. It is argued that the very nature of strategic conflict is determined by the beliefs which the participants have of the objectives, structure and behaviour of the conflictual situation. An observer standing at the door observing the behaviour of the participants in a

struggle may well, by virtue of that distancing, remove himself from that social circle of information which it is necessary to penetrate in order to access the thinking of the informants. This protectionism of the beliefs and assumed knowledge of the participants is not to be underestimated. Frequently, in strategic situations a decision making elite will employ an outsider (consultant) rather than run the risk of releasing sensitive information to a fellow subordinate employee. An emic approach is essential in the strategic application.

Nomothetic/idiographic disjunction

The critique here is that data derived for generalities have no application necessarily for a particular situation at a particular time. In strategic applications one might present the criticism as the observation that — a particular conflict type is resolved by a particular method x% of the time — is of little interest or relevance to the corporate situation, since failure to identify whether a theory is relevant may mean the difference between survival or extinction for our company.

Exclusion of the discovery dimension of inquiry

The insistence in the scientific method of the prior declaration of hypotheses excludes examination of the source of these hypotheses. Only empirically derived hypotheses are deemed to be appropriate.

External critiques

The criticisms offered above are serious ones but could be addressed by the use of qualitative methods either as a replacement for the quantitative approach or by a hybrid approach. Other criticisms exist additionally, however which offer alternative paradigms for inquiry.

Theory-ridden facts

Received wisdom assumes that data observations are made independently of any assumptions about the theory under investigation. It would, however, now

seem 'established beyond objection that theories and facts are quite interdependent - that is, that facts are facts only within some theoretical framework.'
(Guba and Lincoln, 1994, p107)

under-determination of theory

Popper (1959, 1968) among others rejects the verifiability assumptions of the scientific method in favour of an approach which allows a theory to remain 'in play' only to the extent that it has not been falsified by counter-example. The ambition of the scientific approach, then, to be concerned with things that are true is brought sharply into question since the result of the falsification approach is to identify a set of theories which contains no elements which are disproved, but which may contain untrue theories which have not yet been proven to be so. Moreover, because science does not concern itself with theorising about everything which may be true we are left with the situation that the set of allegedly true theories 'in play' in the scientific body of knowledge contains some things which are false and excludes many things which are true.

value-ridden facts

In the context of human activity systems, facts are weighted by the value of the observer. There is thus no recourse to the independent observer status of the natural sciences.

interactive nature of researcher-informant

Strict scientific methodology separates rigidly the researcher as observer and the informant as observed. Evidence exists, however (Lincoln and Guba, 1985) that the interaction between the two parties is unavoidable. In the study of strategic matters, for example, the strategic decision making process is highly observed by competitors (Grant, 1995; Luffman, Lea, Sanderson and Kenny, 1996; Bowman and Faulkner, 1997; Ford and Saren, 1997). The effect of this is that even the knowledge that a competitor is engaged in a strategic review is

of itself a piece of strategic information. The effect is that the integrity and security of the researcher/consultant becomes a vital factor in the effectiveness of the strategy. Unless the researcher/consultant is felt by the informants to be part of the informant's problem (sharing the same business objectives, being 'part of the team') exclusion will be total. This participation then renders any attempt at independence not just futile, but rapidly destructive of the research opportunity. Clients or informants set the agendas in strategic research; they are powerful members of decision making elites, and they will include researcher/consultants only on their terms, and their terms are to embrace the process and the values or be excluded (MacMillan, 1992; Pfeffer, 1981; Huff and Reger, 1987).

On the basis of these arguments, a qualitative approach is adopted for the present work. This is not to say that there is no place for quantitative analyses of particular elements of a situation, but that the essential structures of strategic conflict will be addressed using qualitative paradigms. It is now appropriate to discuss what paradigms are offered in replacement for the positivist scientific method.

Four paradigms will be addressed, namely the positivist and post-positivist traditions, the critical theory paradigm and the closely related interpretivist/constructivist approaches. These last two will, in turn, be divided the better to determine and appreciate their relevance to the strategic problem addressed here. Following Guba and Lincoln (1994) we shall observe the characteristics of each paradigm under the headings of ontological assumptions, epistemological assumptions, and methodological consequences.

positivist

Positivism assumes that there is a reality which can be accessed by directed inquiry. This reality is singular and we converge towards it by examining and declaring cause and effect laws which can then be compared with the underlying reality as if we had access to a fixed set of experimental apparatus. The observer and the observed are viewed as being independent entities, and the investigator can observe without interference and without being

influenced by the observed. It is as if the inquiry is made by an observer standing outside the experimental situation, observing through a one-way mirror. Because of this isolation of observer from observed and the alleged existence of an underlying singular reality, facts can be understood as 'true' or 'false' with a certainty dependent only upon the excellence of the isolation of the observer from the observed and the truth of the theory. Methodologies consist of attempts by the theoriser to state valid theories and then test them against the singular reality. To the extent that they are in concert with what is observed, then they are deemed 'true'.

post positivist

The post-positivist approach, stemming in no small part from the work of Popper (1935) is characterised primarily by the rejection of the verifiable nature of knowledge, and uses, instead the idea of falsifiability. Thus post-positivist science establishes the known as a temporarily accepted 'truth', admitted to the set of true facts only by virtue of its having been tested but never proven wrong. In this paradigm reality is assumed to be apprehended only on a statistical asymptotic basis. Human intelligence is understood to be defective; the ontological assumption can be summarised as that of critical reality by virtue of the need to subject investigative results to as wide a critical a process as is possible in order to ensure as sound a basis for truth as is possible. Methodologically, post-positivism adopts a hybrid view, appending qualitative methods on a fundamentally qualitative structure.

critical

From the viewpoint of the critical or structural school, reality was once singular and available but is distorted by the processes of the application of social, ethnic, economic and other factors, so that the original singular reality is crystalized into a series of structures which we have no reason to reject as the only visible remains of a long lost reality. Since we have no way of unearthing the original we are forced to accept the remaining structures as reality. Epistemologically, critical theory accepts the interdependence between observer and observed, and judges that what can be known is a function as much of the observer as of the observed. Data are value-ridden, and the inquiry is transactional in nature. The

methods of critical theory are built by joint inquiry onto the historically underwritten theories in hand. In other words, the methodologies aim to resolve differences between participants. The critical theory can be said to be strongly related methodologically to the Habermasian concepts of communicative rationality (Habermas, 1981, I and II) and can be summed up neatly in Figure 13, which represents the relationship between the speech-acts of two participants, A1 and A2 and the connection between their communications and acts which affect the objective world and their own views of the world. Habermas adopts an objective in human social intercourse of power-free communication, so that it is only by engaging in a convergence towards rationality as perceived by another that true communication (including research) can be achieved. To the extent that power-free communication is judged to be possible, Habermas's communicative rationality is sustainable.

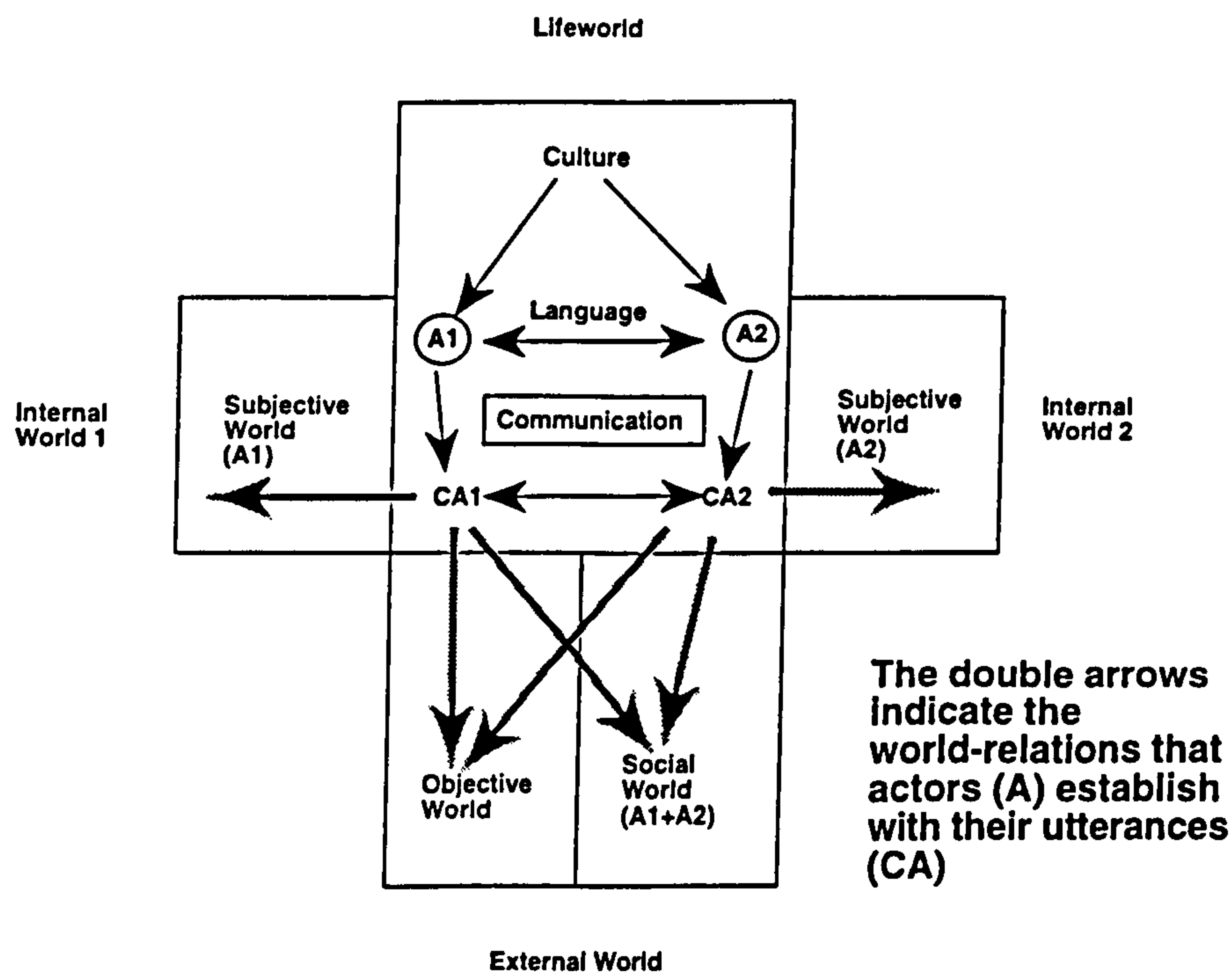


Figure 13 (from Habermas, 1981, II, p 129 The relationship between the objective and subjective worlds of participants

Habermas's conception of the world is of a number of participants (in Figure 13 there are only two) each of which has a limited access to an interpreted subset of an underlying

reality known as the lifeworld. Here he draws from the work of Schutz and Luckmann (1963). These interpreted views of reality are known as the subjective worlds of the participants and are distinct to them individually. Held in common are the social world and the objective world, the latter being the arena in which physical acts take place and the former being the commonly-perceived social structure in which both physical acts and what Habermas calls communicative acts are applied. It can be seen from Figure 13 that the communicative acts of the two participants establish relations between elements of these differing world views. They link the conceptions held by the participants in the respective interpreted versions of the underlying reality, the lifeworld.

The scheme in Figure [13] is meant to illustrate that the lifeworld is constitutive for mutual understanding as such, whereas the formal world-concepts constitute a reference system for that about which mutual understanding is possible: speakers and hearers come to an understanding from out of their common lifeworld about something in the objective social or subjective worlds. (Habermas 1981, II p.126)

In terms of relevance to business strategy, the connection between action, communication and the world views of the participants is clear.

The concept of communicative action singles out, above all, two aspects of this situation management: the teleological aspect of realizing one's aims (or carrying out one's plan of action) and the communicative aspect of interpreting a situation and arriving at some agreement. ... Participants cannot attain their goals if they cannot meet the need for mutual understanding called for by the possibilities of acting in the situation... (Habermas op. cit. pp 126 - 127)

What this means for the design of a strategic research methodology is that action cannot be divorced from understanding nor observation from participation. Inexorably, we must concede, step by step, that attempts to take a non-participatory role in the establishment either of action plans (through the conflict resolution techniques of this work), or of improved world views (through the multi-futures techniques) will constitute an interference with the

system under observation. No such observer role is possible.

interpretivist/constructivist

In this school reality is viewed as being local and specific in nature, multiply and personally observed and experientially based. Any concept of reality is burdened by the particular circumstances of its conception. There may well be a central core of these alternative realities which observers hold in common, but this is no guarantee that the core in question represents an underlying truth, since an additional observer may well offer a reality which does not intersect that core. The constructions which observers make are mutable, as are the posited underlying (multiple) realities. In one respect the observers interpret reality differently (interpretivism), in another they construct reality (constructivism). In the analysis of strategic problems it is difficult to see how anything but a relativist (interpretivist/constructivist) position can be adopted. The views of the participants in a strategic struggle are entirely constructed by themselves. They have control over the value judgements which are applied and it is the application of these value judgements which determines the very structure of the conflict(s) which are being analysed. By application of a Habermasian communicative rationality concept it may be possible to establish as large a common core of the players' constructs as possible, but this will be limited by the combination of different players' value schemes, and by their necessarily deceptive communications one with the other. The strategic problem is essentially one in which no single reality is admissible. This multiplicity of world views (or belief spaces) is dealt with more fully later in this chapter. The position of the interpretivist/constructivist school is that findings are literally 'created' during the process of investigation by the interaction between observer and observed (Bruner, 1986). *'Constructivists are deeply committed to the... view that what we take to be objective knowledge and truth is the result of perspective. Knowledge and truth are created not discovered by mind.'* (Schwandt, 1994, p125). The strategic intervention interpretation of this is that prior to the intervention the nature of the problem itself may be undefined. By jointly experiencing the situation (the emic approach) an appreciation emerges which then becomes the reality of the strategic conflict at least from the point of view of

the informant, who, if she is the strategic decision maker (as is the case in a practical example discussed below) determines what constitutes the conflict. There is no other reality to the strategic conflict beyond the perceptions and value judgement of the strategic informant. This then conditions strongly the methodological approach, which must be a wholly emic one of wholesale involvement and identification with the objectives of the informant/client. The objective of the research/consultancy then becomes to provide an understanding which produces a set of actions which fulfil some performance criteria set by the informant/client, and these, in turn, set the criteria for performance of the research activity.

Table 8 below (after Guba and Lincoln, op. cit, p109) summarises the four paradigms.

<i>item</i>	<i>positivism</i>	<i>post-positivism</i>	<i>critical theory</i>	<i>constructivism</i>
<i>Ontology</i>	single reality and apprehendable	singular 'real' reality but imperfectly apprehended	virtual reality shaped by social, political, cultural economic, ethnic and gender issues; crystallised over time	local and specific constructed realities
<i>Epistemology</i>	findings true	findings probably true	value-mediated findings	created findings
<i>Methodology</i>	quantitive methods chiefly; verification of hypotheses	falsification of hypotheses; may include quantitive/hybrid methods	dialogic/dialectical	participative, involved

Table 8: A comparison of four research paradigms (after Guba and Lincoln)

The impact of the strategic intervention problem on choice of paradigm

Certain attributes of the strategic conflict problem now come into play to limit effectively our freedom of choice of research paradigm. The strategic conflict problem is defined in the minds and action sets of the participants (Stagner, 1967; Gup, 1979; Mitchell, 1981). Often the participants in the conflict do not communicate one with the other at all; tension

breaks out, diplomatic relations are broken off; boards of companies refuse to talk to one another. More frequently the communication between controlling parties is inefficient, sometimes it is deliberately deceitful; troop movements are disguised or intentions kept covert; bidding or coalition strategies are held back. More seriously, perhaps, it is observed in many strategic situations that the very existence of a conflict emerges from the preconceptions of the decision makers (Huff and Schwenk, 1985); the need to act in opposition to a competitor emerges from a sensemaking discussion on the competitive environment, and in that recognition that something needs to be done the strategic conflict takes form and breathes. In this latter instance it is incontestable that the nature of the problem is in the minds and perceptions of the decision makers and that the problem is perceived differently, since until we take action the unassuming competitor may not even know that we present a threat. We have invented the conflict and therefore see it, but until we act the other party may not even accept that there is a conflict.

Here the critical theorist might offer the charge of sophistry; there is a reality (that is, the existence of the conflict) but because of defects in the capability of the other party they cannot perceive the true situation. The counter to this argument is to enquire whether the conflict exists in 'the real world' until something is done about it, i.e. some public action is taken. And yet the conflict does exist — in the planning department's programmes and in the changed perception of how the strategic decision maker now views the outside world and his own organisation's capabilities. Until we invented the conflict we viewed these things in one way, but now that the conflict has been born, we view them with a different potential in mind. The differences between realities are clear.

This argument remains true in the cases where the conflict has been made public, too, because, *mutatis mutandis*, to the extent that we make plans, make sense of the environment and alter our value systems without communication with the competitor, we retain a different reality from that competitor. In terms of Habermas's communicative rationality, we approach his jointly held subjective world view only to the extent that we communi-

cate our rationality. As soon as we begin to hide the rationality of our actions either by withholding information nor by deliberately putting out deceitful information, we lose the likelihood of the convergence inherent in Figure 13 above.

Because of the need for a pluralistic ontological approach, exacerbated by the need for a wholly emic approach to the strategic intervention, it is necessary to examine what such a constructivist paradigm means for research. What product could inquiry result in, and what use could it be in such a relativist universe? We shall address the issues of justification later on.

Guba and Lincoln (1994, p 179) observe that the process of constructivist inquiry begins with the issues or concerns of the informant and the researcher and proceed through a dialectic of analysis, critique and reiteration towards a joint construction. They offer the following list of properties of these constructions. (From Schwandt, 1994 p129)

1. *Constructions are attempts to make sense of or to interpret experience, and most are self-sustaining and self-renewing.*
2. *The structure or quality of a construction that can be held depends on upon "the range or scope of information available to a constructor, and the constructor's sophistication in dealing with that information"*
3. *Constructions are extensively shared, and some of those shared are disciplined constructions", that is, collective attempts to come to common agreements about a state of affairs, for example science.*
4. *Although all constructions must be considered meaningful, some are rightly labelled "malconstruction" because they are "incomplete, simplistic, uninformed, internally inconsistent, or derived by inadequate methodology"*
5. *The judgement as to whether a given construction is malformed can be made only with reference to the paradigm out of which the constructor operates"; in other words, criteria or standards are framework specific...*

6. *One's constructions are challenged when one becomes aware of that new information conflicts with the held construction or when one senses a lack of intellectual sophistication needed to make sense of new information.*

This table of construct properties will be used below in a discussion of justification of method, but here it provides an insight into the nature of the product of constructivist research. The aim is to agree constructs with our informant which satisfy the requirements of Guba and Lincoln's table. As such we shall aim towards a jointly held view of the strategic conflict situation which accords with our jointly held view and which satisfies the criteria, particularly, of item 4, above. Of course, the criteria of item 4 are not the watertight criteria of unfalsified theory espoused by Popper and the post-positivists, but they are the very best we can do under the severe constraints of the strategic conflict decision making process, both in its specifics and as an example of a human activity (and therefore social) system.

Lastly, in the words of Ernst von Glasersfeld (Schwandt, 1991, p16), to know is *'to possess ways and means of acting and thinking that allow one to attain the goals that one happens to have chosen'* Alternatively, *'The validity of a knowledge claim is not to be found in the relationship of reference or correspondence to an independently existing world; rather, a claim is thought to be valid if it is viable or if it provides functional fit, that is if it works to achieve a goal.'* (Schwandt, op cit, p126) This perspective provides an alternative view of the constructivist product, namely that its utility is to be judged in the light of its added capability of allowing us to bring about the jointly held aims with which we engaged in the first moment of intervention, when we stepped from the etic of observer into the emic of participant in the strategic process.

Justification

Meaning of justification in a constructivist paradigm

At first glance the essentially constructivist paradigm argued for above implies a limited expectation of proven validity or justifiability for the theories-in-play of the different players. Moreover, as has been argued, the inaccessibility of other critical players in the strategic conflict application means that comparison of world-view or theories-in-play of the participants is almost always impossible, at least at the time of the conflict. After the conflict we encounter the difficulty of retrospective self-justification and rationalisation of behaviour by the winners and losers, so that even historical comparisons of theories-in-play become limited in their usefulness. Schwandt (1994, p122) observes that, *'The interpretation one makes cannot properly said to be verifiable or testable. Rather, at best, we can appraise the interpretation by applying norms or criteria that are comparable with the very condition that demands that we interpret in the first place. Hence to judge such an interpretation we might use criteria such as thoroughness, coherence, comprehensiveness, and so forth, and ask whether the interpretation is useful, worthy of adoption, and so on.'* Hammersley (1992) reinforces the difficulty of determining which of the theories-in-play accessible to the researcher are valid subjects for examination of validity. He comes to the conclusion that there can be *'... multiple, non-contradictory descriptive and explanatory claims about any phenomenon without denying that if those interpretations are accurate they must correspond in relevant aspects to the phenomena described.'* Schwandt (op.cit.) offers the embodiment of both his and Hammersley's objectives for justification/validity by seeking to focus on *'... intentional meaningful behaviour that is by definition historically, socially and culturally relevant.'* Valerie Janesick (in Denzin and Lincoln, 1994) reinforces the idea of relevance in validity from the point of view of the driver of the particular theory-in-play. *'Validity in qualitative research has to do with description and explanation and whether or not a particular explanation fits a given description. In other words is the explanation credible?'*

The subject and the object of study are expected to use essentially the same resources for their study (Bauman, 1978, p234). In the context of strategic study, then, it should be accepted that the method of justification will not imply a standing outside the theory-in-play; informant and researcher will be expected to make progress only by the sharing of a common method of advance. The emic approach to research, then, is seen to be an element of the justification process as much as of the methodology itself.

A number of writers have addressed the concept of validity in the qualitative research paradigm as a 'hyphenated' validity. (Altheide and Johnson, 1994; Atkinson, 1992; Eisner and Peshkin, 1990; Hammersley, 1990, 1992; Lather, 1993). We have, then, validity as culture, validity as ideology, validity as gender, validity as language, validity as relevance or advocacy, validity as standards (Altheide and Johnson, op cit p488). All these hyphenated validities are end-directed in the sense that they are all different interpretations of the concept of validity as measured by effect and it is this central unifying concept which will be adopted here in the specific context of strategic conflict study and management. We should seek, then, for justification on a largely utilitarian basis. *'Interpretive accounts ... are to be judged on the pragmatic grounds of whether they are useful, fitting, generative of further enquiry and so forth.'* (Schwandt, 1994, p130)

At this point a distinction must be drawn between the measures of validity to which the overall process of intervention and participative enquiry are subject and, on the other hand, those measures of validity which the techniques themselves require. The overall intervention in a strategic situation is subject to all the limitations of validity proof discussed above because of the specificity of the situation, the unrepeatability of 'the experiment' the need for an emic approach and the inaccessibility of other participants. The technique itself, however may be subject to some degree of replicated validity test for its generalizability, replicability and appropriateness of representation over and above the overarching requirement for its specific applications to be subject to the metrics of Schwandt (op.cit.) offered above. These possible metrics for cross-application validity tests are discussed below, but

is must be clearly stated that the ultimate test for validity of such a technique (for the management of strategic conflict) can only be the judgement of the informant and researcher at the time of the intervention as to the effectiveness of the understanding and normative product of the technique at that time, in that situation and with those particular participants.

criteria

The criteria for justification of the techniques and frameworks involved can be divided into those criteria which refer to the internal structures of the approach and those which refer to the external measures of justifiability applied to the results of the technique.

internal

stability

We can reasonably expect that with a well-defined set of entry conditions, the procedures applied should produce stable, repeatable results. This should not be confused with an external requirement of replicability, a requirement which as has been discussed is not within the reach of a method aimed at the representation of strategic conflict. We are concerned here with the stability of the method as a procedure applied after the entry data is fixed. This is analogous to the requirement for a mathematical computational technique that it should not produce different solutions when the data inputs are fixed.

consistency

Related to the stability requirement is the need for the procedures to be internally consistent. There should be no inherent structural reason why the procedure should contradict itself. This is analogous to internal rigour in a mathematical procedure. The expectations of mathematical rigour cannot directly be applied to the procedures as a whole, but we can reasonably

expect there to be logical consistency in the logical or mathematical procedures applied.

traceable

The procedure is expected to be traceable or auditable. This implies that it is possible to express sufficient detail in the procedure to allow an appropriately qualified or experienced person to audit the procedure for the correctness of the steps of calculation or syllogism.

inclusion

It is also expected to provide answers which mirror those of other techniques in so far as those techniques can be audited for correctness. In other words, where an equivalent technique can be shown to produce a particular answer to a conflict where the validity assumptions of that technique are consistent with the assumptions of the derived technique, it is expected that the derived technique will give (at least) the same insight into the solution as the equivalent technique. Where, for example, game theoretic solutions exist for particular stylised conflicts, we should expect the solution set of the derived technique to include those of the game theoretic solution. We can consider it is as a type of triangulation technique.

external

transferability to users

It is reasonable to expect that a technique for practical application should be usable by practitioners other than the inventor. It is not reasonable to expect that the results achieved should be identical for two users, because of the unrepeatability of interventions and nuances of the application of subjective and therefore differently sourced inputs into the technique.

chronological stability

It should be expected that when applied to a historical example the tech-

nique will reflect the progress of the conflict under investigation within the contemporary limits of knowledge of the participants. This is limited by the retrospective self-justification of participants and the desire to perceive a clarity which was not in fact present at the time. While this criterion of validity is limited, it is nevertheless a useful approach.

contemporary validity

During the intervention in which a technique is applied we should expect that the results should align with the perceptions of the researcher and informant(s) at the time. The obvious limitation of this approach is that the technique itself forms part of the strategic intervention, so that interim results form part of the sensemaking of the situation at the time of application. This can be seen clearly in the example of *The Spanish Mayor* (Chapter 9), where, in a retrospective case study, two successive passes of the derived procedure produce different results because after the first pass greater understanding of the situation was achieved, allowing better perception of the important elements of the situation.

contemporary valuation

Critical to the justifiability of the supporting techniques and frameworks under the interpretation of Schwandt and others cited above is the concept of the usefulness of the results to the researcher-informant. Whereas conventional social science techniques tend to value their justifiability (validity) in terms of the social benefit they can produce (Reason, 1981) strategic conflict research cannot afford such a generalised benefit. The cruel reality of strategic conflict is that it takes place within a highly politicised and self-concerned structural power framework. The informants are likely to be managing directors, owners or strategy directors. If they were not powerful people working at managing or describing an important and value-laden

conflict, the latter would not justify their attention. Unless the research intervention is valued more or less continuously throughout the process, it cannot be realistically judged to be effective and therefore justified. The difficulty here is that the power structures of the informants' organisation can laden the strategic conflict process with undeclared values to the extent, potentially, that the valuations publicly expressed of the emerging results (be they sensemaking or action planning) can be distorted by undeclared value systems. This is another reason why the emic approach whereby the researcher becomes a part of and is seen to absorb the values (both process- and end-) of the informant structure is essential to the success and justifiability of the research process (from the point of view of the researcher) and of the strategic decision making process (from the point of view of the client organisation). The position adopted, then, for this present work is that the contemporary valuation of the research intervention and hence of the techniques applied is the extent to which the research process and the techniques contribute to strategic decision making performance in the eyes of the informants and the researcher.

There will be a number of bases on which this last and most important criterion is assessed. The perceived increased capability of the strategic team in sensemaking will be important, as will the efficiency of the process (it may be possible to achieve the same definition of action plan, but with less effort applied). Critically, the internally judged applicability of action plans will be relevant; not only is it necessary for the action plan to be contributory to the business, but the role of the technique in the internal marketing of the plan is an appropriate element of the judgment of the justifiability of the techniques and frameworks. Overall, Schwandt's (1994) usefulness criterion in the context of strategic conflict management is to be interpreted as 'Does the application of the method lead us to believe that we

have a good understanding of the conflict and does this in turn lead to good action plans which are likely to improve our strategic achievement in this conflict?’

method

There is thus a need for the framework and techniques under assessment to be investigated for justifiability using a number of different types of application, aimed collectively at the criteria discussed above. This is done in the present study according to the following schema.

See Table 9.

Assessment method	Example	internal				external			
		stability	consistency	traceable	inclusion	transferability to users	chronological stability	contemporary validity	contemporary valuation
Historical	Mardonius and the Greeks Postage Stamp Crisis		Yes	Yes	Yes	Yes	Yes		
	Spanish Mayor		Yes	Yes	Yes	Yes	Yes	Yes	Yes
ex ante (real time)	Battle for Trafalgar BAe's naval business Project staffing OSF negotiation		Yes	Yes		Yes	Yes	Yes	Yes
Analytical comparative	Prisoners' Dilemma Chicken Battle of the Buddies	Yes	Yes	Yes	Yes				

Table 9: Contribution of assessment methods to justifiability argument

It can be seen that no single method of assessment is sufficiently broad to allow full justifiability on its own. There is a fundamental disjunction between the need for the perspective of distance (and therefore a historical, *ex post* method) and a real-time (*ex ante*) approach. The former allows some degree of comparison between what the techniques predicted should happen in a conflict, but is tainted by the distortion of the reconstructivist tendencies to which all *ex post* data is subject. We do not have the control over the data that we should expect in a positivist environment; each contributor or participant has her own

view of the events that happened, or at least the extent to which knowledge was available. Conversely the real-time *ex ante* approach has the advantage that the technique can be tested against the future, but has the real disadvantage that the view points of the participants are changing throughout the application. Lastly, the analytical, internal consistency test methods (logical structure and comparison with analytical methods) are insufficiently rich to allow, on their own, an adequate test. It is asserted here, on the basis of the coverage within Table 9, that the assessment methods shown collectively provide a good basis for a justifiability test.

Intervention inquiry strategy

Within a generally constructivist paradigm, three approaches are commonly applied to the research process (Reason, 1981 p324, 325), namely Cooperative Inquiry, Participatory Action Research and Action Science/Action Inquiry.

Cooperative Inquiry

Stemming from the work of Heron (1971), Maslow (1968) and Shrivastava, Obert and Neilson (1971) among others, Cooperative Inquiry assumes that the subjects of research can free themselves from the burden of their previous experiences and, in particular of restrictive social processes. In a sense, then it is related to the Habermasian power-free communicative act concept, using the communicative rationality of a group of researcher/informants to engage in '*open, authentic communication*' (Reason, op cit, p 325).

The essential foundation of Cooperative Inquiry is summarised by Reason (op cit, p326) as follows. '*... in cooperative inquiry, all those involved in the research are both co-researchers, whose thinking and decision making contribute to generating ideas, designing and managing the programme and drawing conclusions from the experiment; and also co-subjects, participating in the activity being researched.*'

While the four phase process as described by Heron (1981) (agreement of a topic, application, total immersion and reconsideration) are expressed in the general literature as involv-

ing both researcher and informant(s) in a socially improving programme of research which, because of the context of strategic intervention is inapplicable, the main tenets are still appropriate. The methodological lessons to be learned here are that the researcher should align completely with the tenets and value of the informants, consciously and publicly avowing the aims of the informants. Such devices as referring to 'our' company, 'our' objectives 'our competitors' and of adopting a conspiratorial style of communication with the informant (adopting a project key word, communicating in a deliberately obfuscatory style using a developing private vocabulary) are essential and effective in breaking down the barriers between outsider and the informant. There is, of course, an element of trust in this relationship which stems from a joint appreciation of competence. The informants are generally at high levels in their companies and therefore expect to engage in some sort of competence assessment before adopting the joint objectives avowed by the researcher. Cooperative Inquiry '*rests on a collaborative encounter with experience*' (Reason and Rowan, 1981) and this provides a useful test for research validity. If the respondent is seen to include the researcher in the same broadcast of progress as his own staff, for example, one can be confident that the collaborative tissue is intact. This will be seen to be the case in the associated studies.

Participative Action Research (PAR)

The primary task of PAR is '*the enlightenment and waking of common peoples*' (Fals-Borda and Rahman, 1991, p vi), and while such a general objective is deeply inconsistent with the power-laden agenda of strategic research, there are elements which are useful in the study of strategic conflict. A secondary tenet is that knowledge can be gained through the experience of *dasein*, (being-in-the-world); the lived experience of people is a valid basis for the type of knowledge achievable by a constructivist research methodology. The elements from PAR which are included specifically in this research are the ideas that research is a collective empowerment and that genuine commitment to a worthy aim (in PAR proper, a social aim; here a strategic aim) produces a forward moving research agenda.

Action Science/Action Inquiry

The important work of Argyris and of Torbert in establishing a theory of action and a corresponding action research methodology represents the essential structure of the Action Inquiry approach (Argyris and Schon, 1974, 1978; Torbert, 1976,1991; Argyris, Putnam and Smith, 1985). The underlying theory of action bears strongly on the way in which a well-constructed strategic framework is observant not just of the conflict which it is engaged in representing, but also of the representation process itself. This is the essence of the Argyris *double-loop learning* which refers to ‘*the capacity of individuals to reflect on and amend not only their action strategies but also the governing variables behind those strategies*’ (Reason, 1994, p 330) Writers on the action science/inquiry process identify two models or theories of action which are relevant. Model I is described as a defensive theory that limits action science (Reason, op cit, p330) while Model II offers a ‘normative perspective that guides the action scientist’ (ibid.). The models are summarised in table 10 below.

<i>Model I</i>	<i>Model II</i>
to achieve the purpose as the actor defines it	valid information
to win not lose	free and informed choice
to suppress negative feelings	internal commitment
to emphasise rationality	

Table 10: Comparison of two models of action theory (after Reason)

There is a clear disjunction between the aims of the strategic process in conflict and that of

Model II, advocated by Argyris. It is quite clear that any attempt to argue an emergent strategic behaviour in pursuit of Model II would result in an approach which, at least at the beginning of a strategic intervention, would be unacceptable to strategic decision makers. The theory has, however, moved on, and the most recent interpretations (Torbert, op cit) emphasise four 'territories' of human knowledge, namely knowledge of purpose, knowledge of strategy, of behavioural choices and of the outside world, the latter emphasising the knowledge of the consequences of the adopted behaviour. It will be seen that these territories of knowledge constitute the inputs or outputs of a strategic conflict technique, and Torbert's perspective aligns well with the effect of a good conflict resolution tool in disciplining the explicit declaration of objectives and preferences, the derived structuring of the choices available to the client organisation in the particular situation, and the effect of the action on the structure and outcomes of the conflict. Additionally the Torbert structure emphasises the importance to the strategic process of an examination of the surrounding context of the particular conflict. The Argyris double-loop learning (Argyris and Schon, 1978) is embodied here in a growing and iterative understanding of the conflict situation as a technique is successively applied.

The main arena of applicability of the Argyris and Schon (1974, 1978) approach is in the organisational aspects of strategic implementation; the mobilisation of the assets of an organisation towards a strategic end, be that action itself or sensemaking. As such, then, it is seen within the context of the present work as an implementation structure rather than as an intervention structure.

Implications on intervention methods

These considerations, by which the cooperative inquiry approach is adopted for the framework of intervention (honouring certain elements of PAR and action science/inquiry as discussed) leads to certain methodological implications.

The approach adopted requires the whole hearted adoption of the values and objectives of the informant organisation during an intervention. This avowal of the client organisation's

aims must be public and without reservations, since, at the strategic level of intervention the issues of security and commitment are indistinguishable. Techniques adopted during the research activity ranged from the vocabulary used ('our' rather than 'your') to the adoption of tacit assumptions of the aims of the research which clearly aligned with the often unexpressed assumptions of the informant. Care was taken to test the assumptions of informants, on the argument that at this level of intervention, the researcher was frequently tested to ensure that his competence and professionalism were appropriate to the task. Similarly, this testing of competence was applied to the informants, on the basis that if they were not competent and did not feel that they were competent, the competence of the researcher and the research was in question.

The competence of the researcher was always presented informally early in the interventions. The career history of the researcher, the fact that he had operated at the strategic level in a major company, the relevance of academic and professional training were all mobilised to condition the informant that here was a colleague who could be trusted, even to the extent that the researcher's competence may provide a place of security for an informant who felt insecure in the thin and unfamiliar atmosphere of strategic decision making. This was particularly the case with the owner/MD of OSF who clearly felt ill at ease with having to shift her attention from the operational level of decisions, with which she had a great confidence and a corresponding ability in making, to the unfamiliar strategic level of decision making. In her case the ability gap was clearly due only to the unfamiliarity of the type of decision making; after a short time she was clearly at ease with the different vocabulary and freedom of action implied in strategic decision making.

In the light of the need to achieve a seamless integration with the informants it was judged important not to use a tape-recorder to record intervention events, nor was it deemed appropriate to make any notes when in contact with the client other than those necessary to undertake the action task. In other words, it was decided that extensive note-taking would indicate a role for the researcher which was different from that of the colleague/partner in

decision making. This proved extremely successful. The process, then, can be thought of as as a semi-structured interviewing technique where the process of the strategic decision making tool itself was the agenda. Notes were written up directly on computer as working papers and presented to the informants as if they were internal notes, albeit not on company paper. These computer notes form the detailed basis of the case studies in this work. Care was taken that the style of writing reflected only the strategic decision making task in hand.

The intervention surround was carefully managed so that contact was made exactly as if the researcher were a senior colleague of the informant. Where it would have been appropriate, for example, to telephone a colleague at home because information derived was particularly potent or insightful, this was done. Equally, care was taken to comply with the often opaque rules of dress and behaviour of the organisation were adhered to. An example is the *BAe Project Staffing* case where the researcher had to dress up for a meeting in his own home in a business suit, shirt and tie in order to continue the impression of a colleague rather than a member of a university staff.

Wherever appropriate the researcher obtained invitations to other consultancy/support meetings (e.g. with bankers, accountants etc.) in order to achieve parity with the informant in their eyes. Thus the researcher was seen as a colleague of the informant, and this coherence of position was thereby strengthened through the nonverbal communications of the third party.

Wherever possible a third party was used to triangulate the analysis of the strategic conflict. In the *BAe Project Staffing* problem, for example, the highly experienced technical consultant who contributed to the analysis was used to crosscheck the appropriateness of the conclusions by examining the raw notes during the progress. His experience also provided a crosscheck on the reasonableness of the results; by virtue of his thirty years experience in project situations similar to that under examination, he could easily check the sense of the results of the models.

'Getting in', the process of achieving the trust of an informant (Fontana and Frey, 1994, p366,367) was not an issue in any of the interventions because of the procedure described above. The degree of involvement was easily detected through the nonverbal language of the informants, though their style and volubility of communication, through their use of appropriate pronouns and through the degree of trust they showed in sharing highly privileged information, much of it price-sensitive in the extreme, with the researcher.

Overall study methodology

Overall Approach

The general approach or research strategy adopted during the study was a combination of well-known design techniques used extensively in the management science literature, together with a controlled intervention methodology for the case study work. The latter is described above, and fits within the overall conduct of the work as shown in Figure 14. Here it will be seen that the overall approach follows the *shaping - designing - comparing - choosing* paradigm of Friend (1989) described more fully below. This approach disciplines the designer into well-defined phases of problem statement (shaping), conceptual design or modelling (designing), comparison of various design options (comparing) and lastly choosing between design options or models in order to determine the design option most likely to satisfy the problem set in the shaping phase. This was amended in two ways for the study.

1. Iterative Design Approach

Firstly, Friend's methodology which has been successfully applied for the general modelling of social science and particularly business situations is essentially linear. Little feedback is postulated between the *shaping - designing - comparing - choosing* elements. One reason for this is a desire on the part of the modeller not to have the characteristics of the model retrospectively tainted by the results of any comparison with reality or the test environment, since there is a danger in an observational

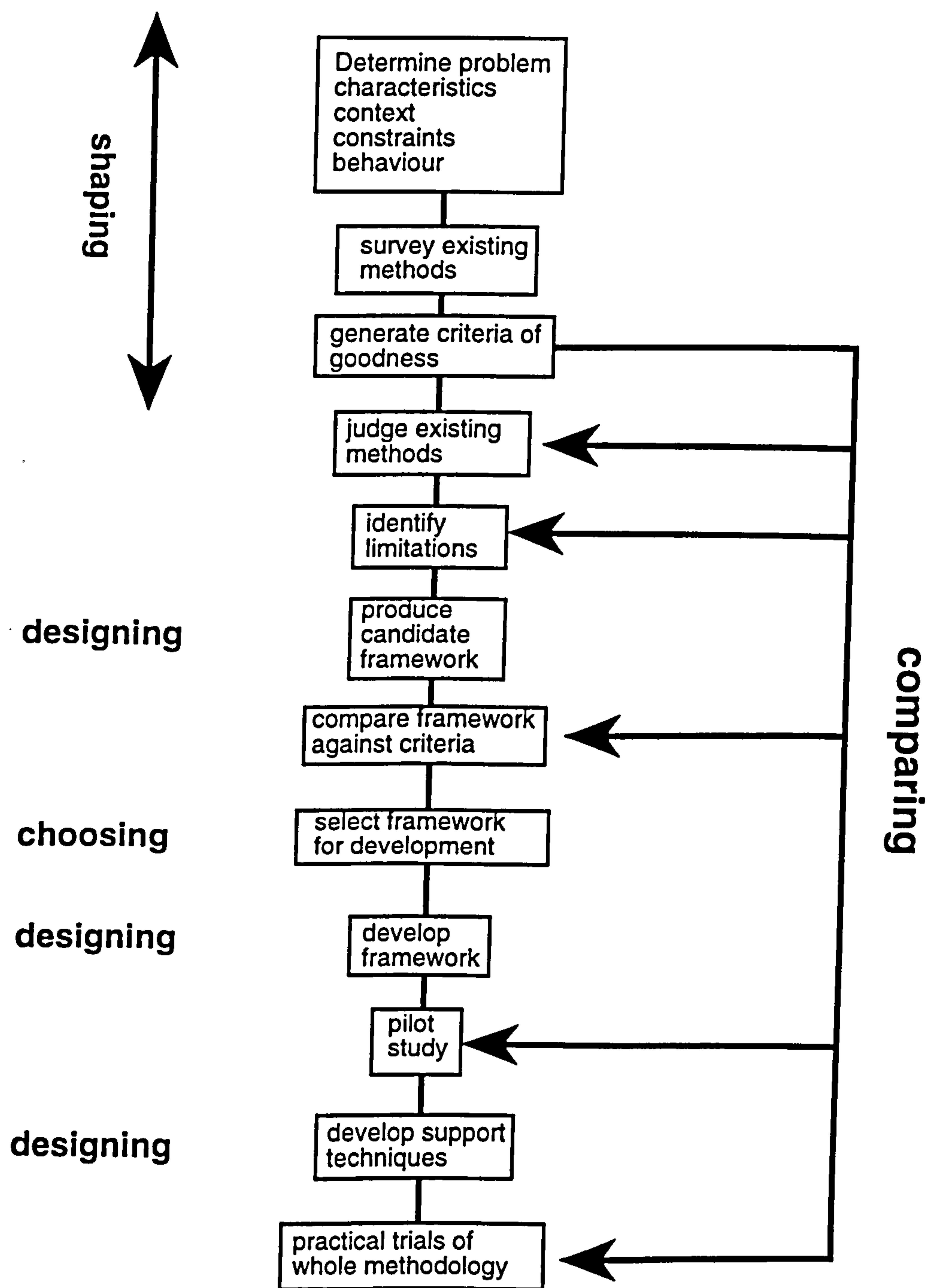


Figure 14: Overall approach of study

use of the method that the model may be retrospectively amended to produce the results which the researcher would have wished for in the test situation. It is a kind of control in the experimental design sense. Additionally, this insulation of each phase from the others is a means of disciplining client users into partitioning their thinking about what can often be highly complex and ill-defined problems. The partitioning helps to divide up the problem and the solution into manageable parts which the client user is more able to address.

Since, in this application, the method is being used to design a methodology or framework rather than a model of a business or social science system, neither of the two constraints above need apply. In the case of the need to provide a control mechanism, recourse to reality takes place at the level of the application of the methodology to case study material. Any attempt on the part of the designer to claim unjustifiable adequacy at the design stage would be found out at the independent case study stage. In respect of the need to partition the problem to reduce the complexity for a client user, the constraint need not apply because of the increased amount of time available for the study compared with the often severe time constraints applicable in intervention with the client organisation.

These observations allowed the amendment of the Friend design methodology to allow an iterative design approach. Thus, when initial case study work had been carried out, the specification of the elements of the framework could be amended in the light of that experience. Similarly, at the stage when the framework as a whole was trialled, practical experience allowed the design to be modified in order to make the methodology and its underlying techniques more usable.

2. Inclusion of Case study material

The second respect in which the Friend methodology was amended was in the insertion of case study work as a recourse to a test environment in the middle of the design process. The Friend methodology is essentially conceived as a design method

for the modelling of social science systems and, as such, because of the intervention difficulties and dangers of disturbance of the subject system, Friend (op. cit.) advises that the process should be carried through essentially in one pass. Clearly, when applying the method to a methodology design, opportunity exists, without the danger of inappropriately disturbing a subject system, to apply the methodology in a partly finished form. The effectiveness of the methodology is then assessed and design changes may result. In the case of the application of the methodology to the modelling of specific problem, the observed social system will be affected by the application of the model, and if the researcher's task is to model the original system, no second recourse to reality can be made.

In the case of its application to a methodology, however, no such constraint applies, since even complete failure of the emergent methodology in one application will not affect the likelihood of its being effective (suitably amended) in another application. In point of fact the trial applications of the method were generally successful, but lessons were learned in early applications which were later utilised in others. In particular, lessons learned in the elicitation phase of the multi-futures technique which forms part of the framework were mobilised to good effect in subsequent elicitation phases in the application of the conflict resolution technique.

Section IV:

A Solution Framework and its elements

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An approach - foveal games

key concepts and their origins
general description

Chapter 6:

Strategic futures and FAR

general description
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Chapter 5:

An approach to strategic conflict: Foveal Games

Key concepts and their origins

The discussions of Chapters 2 and 3, of the strategic decision making process and the existing approaches respectively, contain certain key concepts whose juxtaposition leads naturally to a type of structure, the Foveal Game approach, which presents good expectations of satisfying the requirements of Table 4 and of being workable and practicable in its results.

Discrete structures

The view of the strategic environment as a set of discrete states between which the world can move is contained within the connected concepts of Field Anomaly Relaxation (FAR) (Rhyne, 1974, 1980) and of scenario planning in general (Schnaars, 1990; Shoemaker, 1995; Moyer, 1996). The latter tends to be more concerned with developing a view of the future which is pluralist as such, whereas the former is, at least to some extent aware that, in a treelike structure of possibilities (See Figure 12), transitions between the junctions of the tree, the discrete states, are possible.

Transition-based analysis

In addition to the strict mathematical structures adopted by Washburn (1990) in explicitly addressing directed graph games, a number of writers, such as Boulding (1962), Brams (1994), Howard (1971) and Fraser and Hipel (1984), have attempted to analyse conflict generally or game theoretic problems specifically by a transition-based approach. The rudimentary approaches of examining what set of single move tactical choices needed to be made by the participants in order to constitute a change of state (expressed most usually as an outcome) was extended by Howard and by Fraser and Hipel to include consideration of the consequences of opponents' subsequent moves.

Game theoretic equilibrium concepts

The ideas of an equilibrium being a state of the game from which there is no motivation for any party to make a move of which that player is capable is contained in the game theory literature at large, and particularly in the equilibrium concepts of Nash.

Multiplicity of belief spaces or viewpoints

The variable universe games of Bacharach and the epistemological literature dealing with pluralist ontological viewpoints leads to an image of a strategic context as being a struggle in which the players may disagree about the very structure of the game. Multiple valid viewpoints may exist at all stages of the struggle.

Iterative solution processes

Checkland's (1981, 1990) SSM procedure, among many others, lends the idea of an iterative sensemaking of a complex scene, where the analysis at any one stage of the procedure produces intertwined action and sensemaking products. The former directly affects the lifeworld and hence alters the environment of the conflict, and the latter provides both a renewed understanding of the problem and an insight into the targeting of sensemaking resources. This connection between action and structure is also seen in Heap and Varoufakis' (1995 pp 29,30) critique of game theory.

Layering and focusing

The nature of the strategic process in some large companies, as has been shown in Figure 2, is layered. This constitutes a focusing of attention when dealing with the strategic process in one layer in that considerations addressed at the next higher level are taken as boundary conditions or as a constraint/mandate instruction for the active layer. In other words, the decision making at the highest level of a company defines the freedom of action for decision making and action planning at the next level down, whereas feasibility statements at

this lower level will condition the appropriateness and feasibility of strategic thought at the next higher level and will thereby, correspondingly constrain it. The human eye/brain combination also works in this way, in that an object of interest is placed at the fovea of the retina in order to view it more accurately and with a higher resolution. If an object of greater interest (say, a bright light or a wild animal) appears in the periphery of vision, that is moved to the fovea of the eye (Pirenne, 1948; Polyak, 1941). Thus an object of interest forms the centre of focus while an awareness of the periphery is maintained at lower optical resolution. We focus upon the object of interest under an assumption that it remains the object most of interest, while 'scanning' the periphery continually to check the validity of that assumption of importance. Checkland's SSM approach can also be seen in this light.

Meta-methodologies

The concept of a methodology which links together a series of lower level techniques or methodologies emerges from much of the discussion of Chapters 2 and 3. Such an overarching methodology mobilises the usefulness of a series of lower level tool which, of themselves may not be sufficient to address the problem in hand.

The Foveal Game Approach: General description

Main characteristics

These concepts lead naturally to a strategic conflict management framework which exhibits the following characteristics:-

discrete state-based

The future developments of the strategic conflict situation should appear as a set of discrete futures, analogous with the branching points of FAR among which the situation moves. Whereas FAR shows these futures as linked by one-way paths, the wider strategic conflict requirement is for a network (in

contrast with FAR's tree structure) which allows regression to a previous state, on the basis that, at least in some strategic conflict situations, positions can be recovered when left. The basis of analysis for action planning, then, is the struggle between players to control those transitions which they wish to bring about and to attenuate those which they judge undesirable.

game theoretic

The extensive work done on game theoretic equilibrium definition is not to be discarded, in spite of the apparently arbitrary nature of the Nash equilibrium concept. In particular, the plurality of solutions discovered by analysis based on the Nash equilibrium should be viewed as an expression of the complexity of the conflict situation and the uncertainties therein rather than necessarily as a failure of the solution method underlying the framework. In the light of the difficulties over transferability of utility functions (Allais, 1953; Hirschleifer and Riley, 1992), the framework should represent the utility of outcomes by a preference ordering.

high and low resolution representation

In order to encompass the requirement for a depth-changing characteristic of the framework, the representation of conflict is to be analogous with the attention-focusing typified by the human eye-brain combination. In other words, the framework should be able to focus on a locality of the conflict, a subset of the wider discrete state network such that a small subset of that wider framework can be more closely resolved. Thus the framework should be able to 'zoom' in and out of a particular part of the whole network, resolving that particular part in more detail as necessary. It is from this ability to focus attention on a (possibly temporarily) significant or dominant part of the complex conflict resolution problem, from which the foveal game approach derives its name. A necessary consequence of such a high-low resolution approach is the maintenance task of continuing to pay atten-

tion to the general scene while more detailed assessment of a subset of the wider network is being made. Within the local subset, it should be possible to mobilise a number of the existing more specific methods available in the domain of micro-economics and/or game theory. Alternatively, the local game may be embodied as a directed graph game identical in nature to the strategic graph game but dealing with a subset of the futures or outcomes of the strategic game. In other words, the local game can be a microcosm of the strategic game.

multiple belief spaces

The essentially different viewpoints of players (who may not be in communication) must be comprehended, so that the discrete state network itself may be differently perceived by the different players, in addition to the valuation of outcomes being different.

The framework: Strategic and local games

The resultant framework is shown in Figure 15

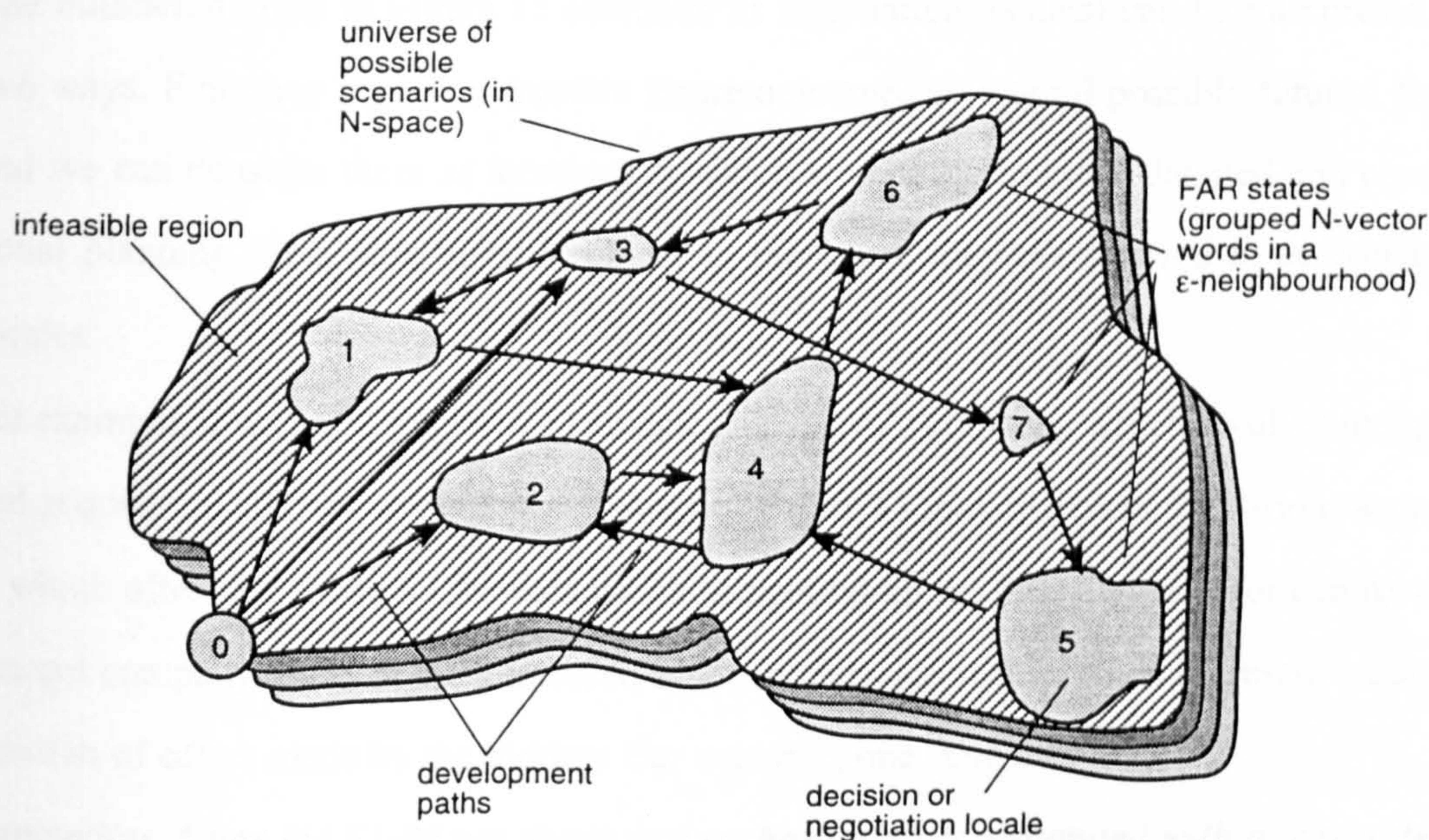


Figure 15: The basic foveal game structure showing the strategic level network, the links between states and the different belief spaces of the players

Strategic graph and transitions

Figure 15 shows a shaded area in which there are numbered locales (indicated as decision or negotiation locales). The shaded area represents the totality of futures or outcomes for the conflict, whether they are feasible or not. Within that universe of futures there are some subsets (the decision locales) which represent futures which could be reached from the present state (locale 0). The locales numbered 0 to 7, then, can be considered as nodes on a network of possible futures which are linked by transitions, shown in Figure 15 as arrows. Sometimes the arrows may be unidirectional, indicating that the move is only possible in the direction shown. Often the arrows will be bidirectional.

The layers in Figure 15 represent the different belief spaces of the players. Each sheet of the diagram could then represent a substantially different picture of the conflict, according to the different understandings of the various players.

It will be seen later that this network, or strategic graph, as it will be known, can conveniently be represented by an extension to the Rhyne (1974, 1980) FAR technique by reconfiguring the feasible future states as a network rather than as a tree.

Decision locales

The numbered areas in Figure 15 (decision or negotiation locales) can be interpreted in two ways. First they represent feasible future outcomes among all possible futures. Second we can consider them as locations at which we engage in more detailed and conditional planning for a more local struggle. In this sense they are referred to as decision locales.

For example, if we are engaged in a strategic analysis of a company which involves merger and acquisition activity, the numbered states of Figure 15 may represent the various stages at which offers are made by the companies competing on the Stock Market for control of a target company. Each of the numbered states, or decision locales, then represent a combination of offers made by the bidders. For example, one state may be

Competitor A has bid £3-89 per share and we have not yet responded with our counter bid. No other bids have been made.

While this may be an entirely adequate description of the decision locale in question at the strategic level, it does not have sufficient detail to allow the planning of the negotiations which may be assumed to be taking place between ourselves and the board of the target company. Nevertheless within the overall strategic planning of the acquisition process it defines succinctly and adequately the state of affairs.

Within the decision locale, then, we conceive of a more detailed local examination (here the detailed planning of the negotiations with the target company's board) of what is required to achieve the result we desire at that position in the strategic graph. To the extent that this can be achieved in practice, we can simplify the planning process by disconnecting the local issues within the decision locale from the strategic issues represented in the strategic graph. The process is shown for the particular case of a market strategy analysis in Figure 16, where the corporate market strategy breaks down into line of business (LOB) and project strategies, each mandated by the higher level of strategic policy.

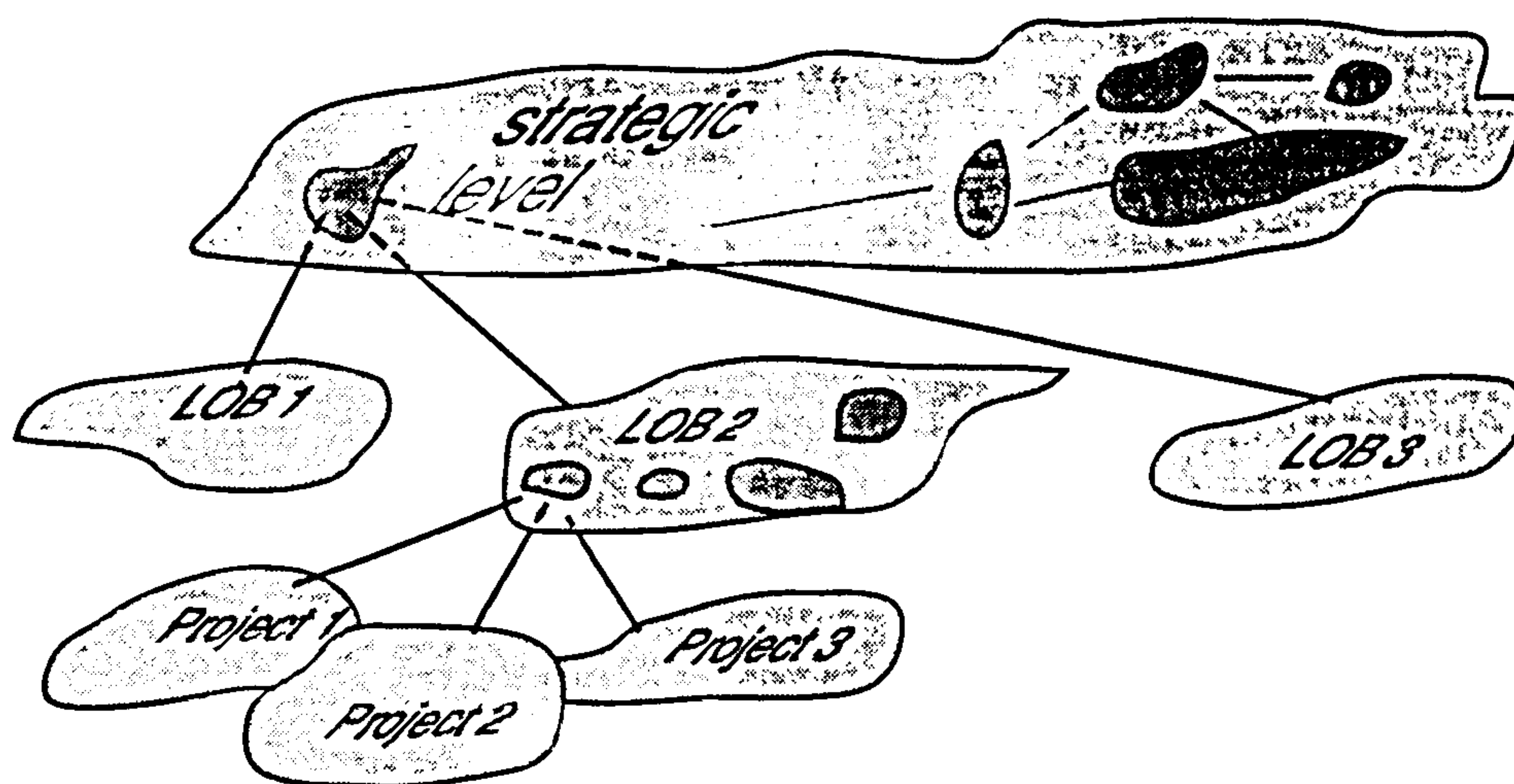


Figure 16: Resolution of the strategic graph

Maintenance of validity of the decision locale

While this focusing of attention on the detailed planning requirements at a decision locale allows a simplification of the planning process, it has certain dangers. Let us take the example of the merger and acquisition planning of the previous section. We carry out our detailed negotiation planning on the assumption that our competitor has bid £3-89 as stated

and that we have not yet responded. We subsequently put our representative in front of the board of the target company in order the better to estimate what response we should make. If, during those conversations with the target company's board we detect that there is, in fact, another bid (from Company B) on the table we would think very carefully whether our negotiating plan remained valid. In all probability we should discreetly withdraw, reconsider the global, strategic situation (now fundamentally changed with the appearance of another interested party) and only return to the detailed, local planning when we had ascertained the strategic position afresh.

We see here a process of constant examination of the validity of the boundary conditions by which the strategic level defines the decision locale. In a complementary fashion, information gained at the decision locale level informs the appreciation of the strategic situation. While working at the local level on the detailed planning we keep in mind that our localised planning and the mandate for our action remain valid only to the extent that the boundary conditions which define the decision locale remain valid.

Figure 17 shows this in a form familiar to practitioners of game theory.

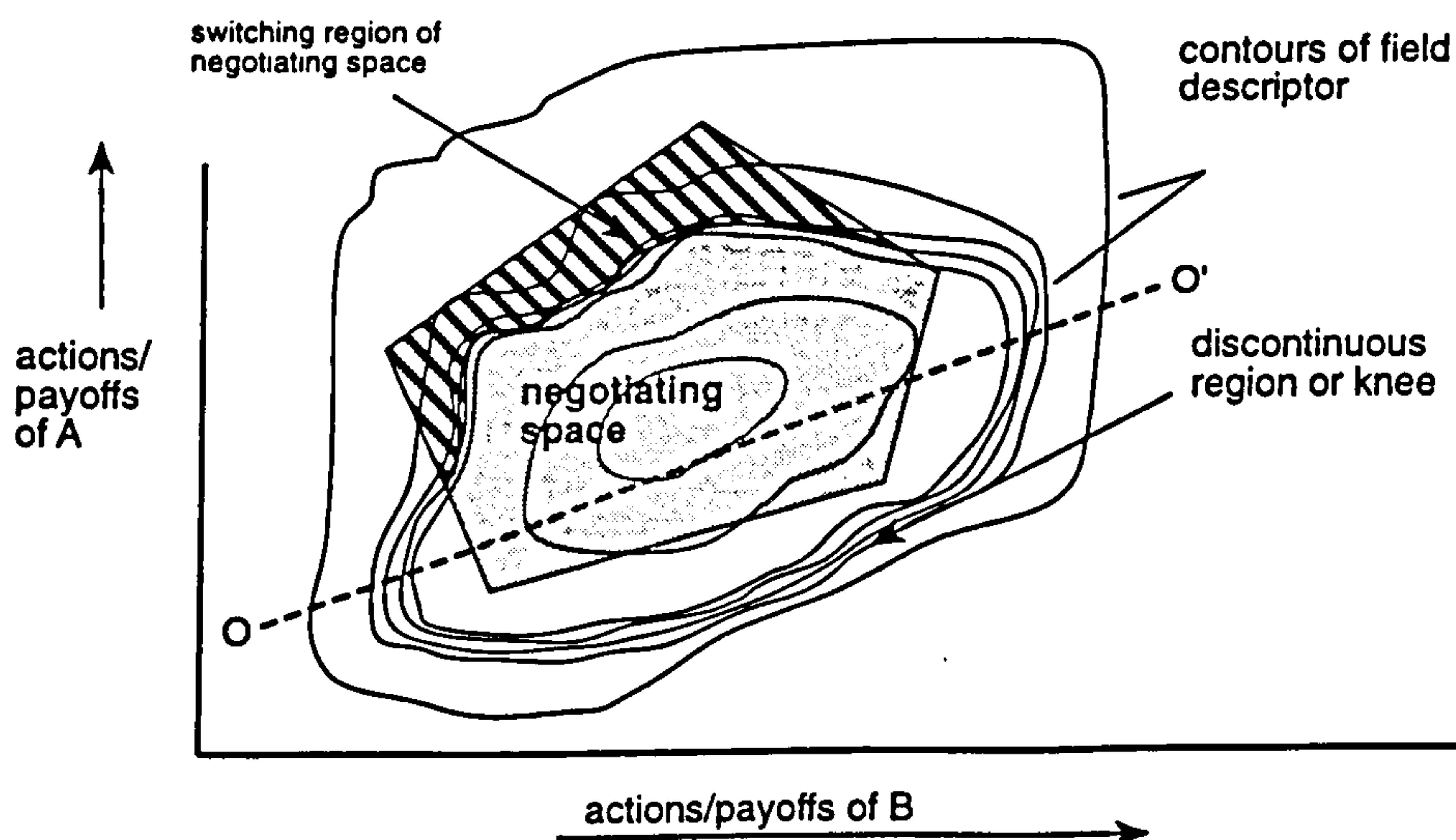


Figure 17: The connection between decision locale and strategic context.

The diagram shows a conventional two-player game-theoretic bargaining space (marked **negotiating space**) within which the players *A* and *B* can choose to agree on a joint out-

come. The polygon thus represents all the deals to which they could agree within this opportunity for agreement and which are consistent with the players' valuations. This polygon, within this simplified structure, represents the decision locale in question.

In Figure 17 the effect of these possible deals upon the field values which describe the strategic position are shown as a set of contours. The situation within the decision locale may have some effect on any of the field values which define the position within the strategic graph of Figure 15; here the effect on only one, arbitrary field value is shown. For example, in our example of the companies bidding for control of a target company, the negotiating space may be defined simply by the perceived pay-offs of bidder and recipient for the sale of the target company, but the decision locale may be partly defined at the strategic level by a liquidity condition on the bidding company. Clearly if the bid is driven in too expensive a direction, the negotiation may remain within the negotiating space of the local bargaining problem, but the strategic situation may be changed — i.e. the valuation of the deal may be most favourable, but the resulting overall cash-flow may be unacceptable.

The strategic graph of Figure 15 can also be considered as a N -space of combinations of N field descriptors (as in FAR) each combination of which describes a conceivable future (outcome). There will be subset of that N -space which comprises all those feasible futures and these feasible futures can, again as in FAR be grouped or clustered in to decision locales. These clusters of future states, as described above, then define the boundary conditions for the detailed planning at the decision locales. On occasion, however, activities which take place (or indeed new perceptions gained) within the decision locale will affect the actual values of the field values which define the position in the strategic N -space. If actions taken within the decision locale affect the field variables of the strategic N -space to the extent that the boundary conditions of the decision locale previously assumed become invalid, then planning must revert to the strategic graph level.

The decision locales sit within the strategic N -space as shown in Figure 18.

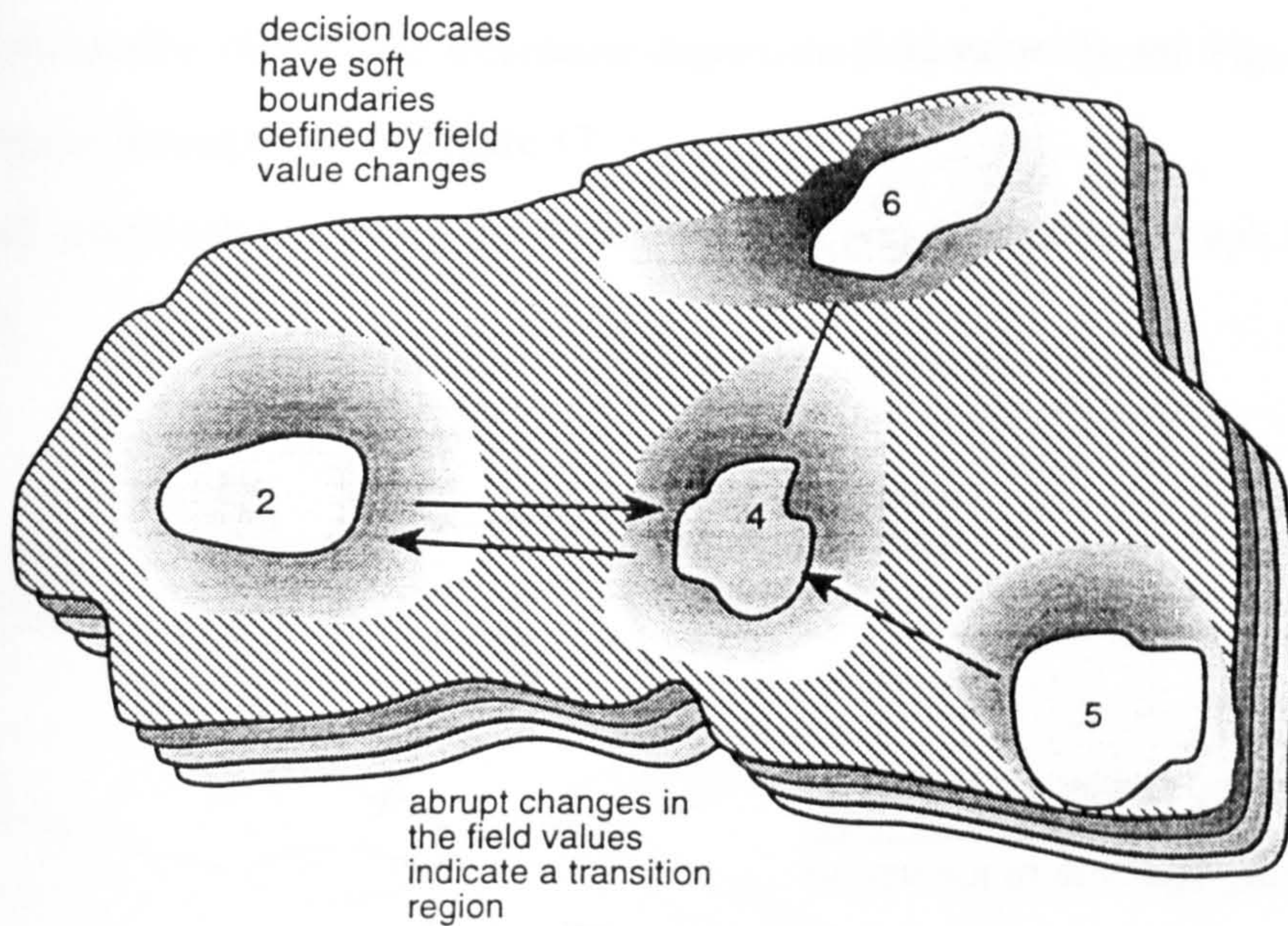


Figure 18: Action within the decision locales may affect the position within the strategic field (N-space)

This movement within the strategic *N*-space as a result of local action may result in sudden changes in the field values of the strategic *N*-space (the contours of Figure 17). In this case there may be a switching region where the validity of the boundary conditions of the decision locale may not be able to be clearly judged.

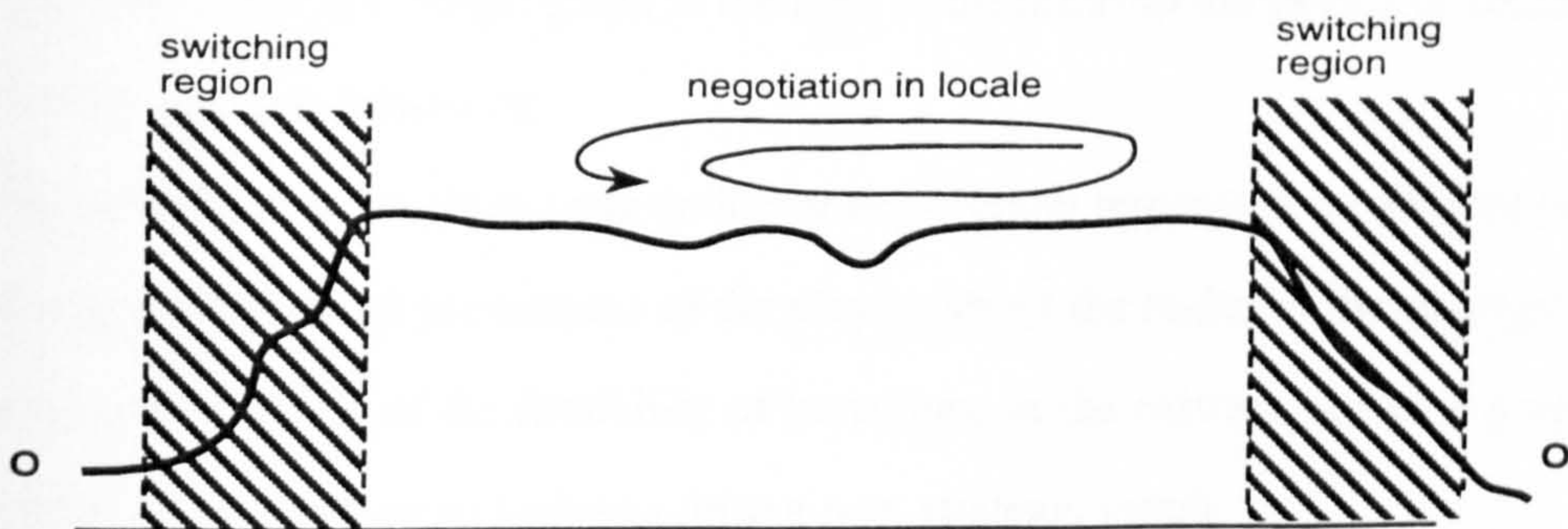


Figure 19: Action taken within the decision locale may render the boundary conditions invalid. This can happen suddenly or gradually.

In Figure 19 we see a field value (marked *o* - *o'*) in the strategic *N*-space which is being

affected by action within the decision locale. Within the switching regions shown, the action taken locally affects to an increasing degree, the field value shown. Figure 19 represents a section through *o-o'* of Figure 17.

The overall relationship between the decision locales and the strategic graph is shown in Figure 20.

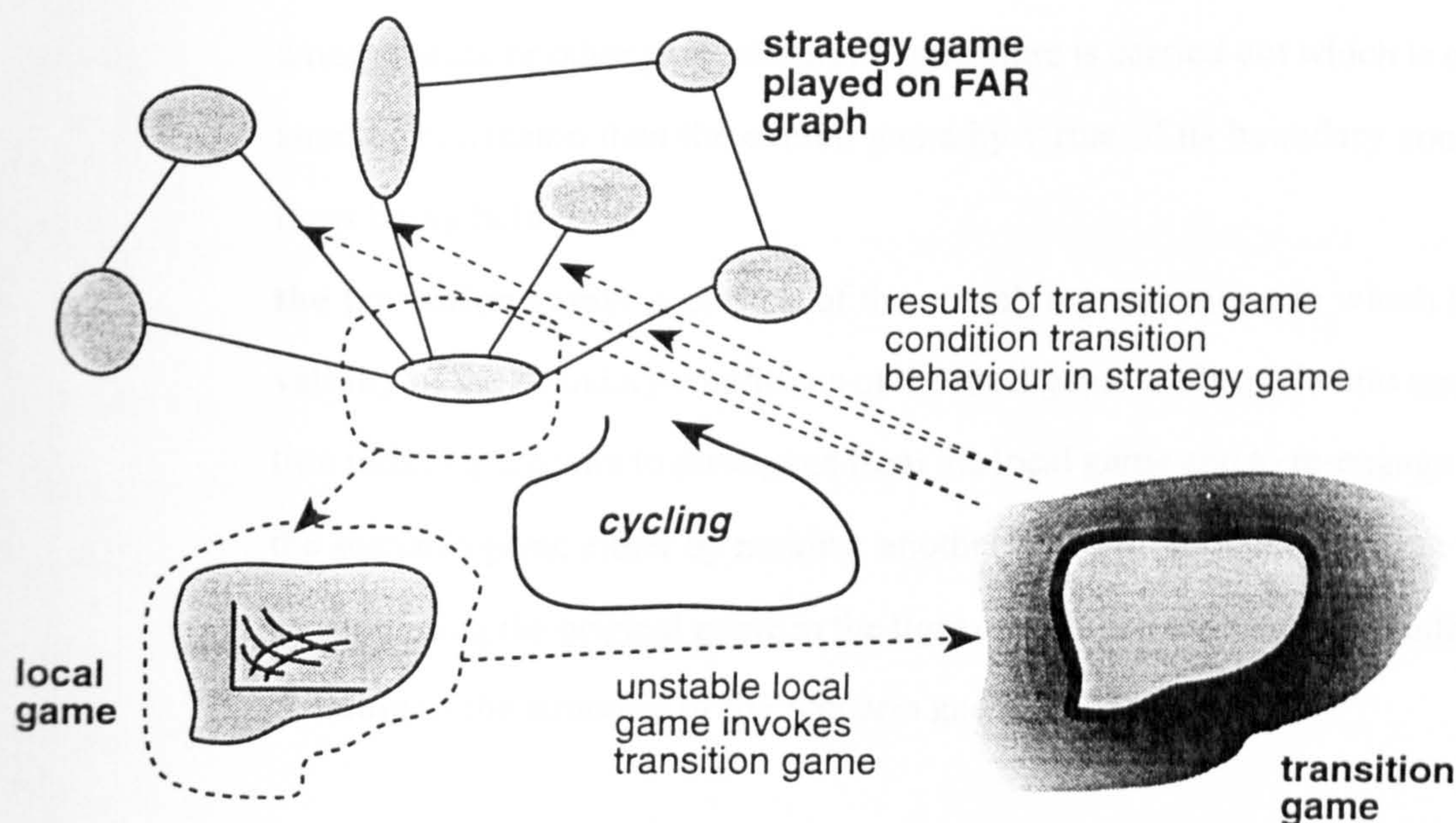


Figure 20: Overall cyclic structure of the foveal game framework

This reappraisal of the strategic graph in the light of the information gained or action taken at the local level can consist of:

- a) a new judgement as to which node on the strategic graph represents the present position
- b) a new judgment of the preferences of the players about the nodes of the strategic graph
- c) a new understanding of the feasibility of transitions in the existing strategic graph
- d) the addition or deletion of nodes to form a new strategic graph.

The foveal game structure concisely then is as follows:-

the scenario game: A directed graph structure of heuristically derived scenarios representing possible futures upon which a game is played in which

the participants attempt to move the state of the game from less desirable scenarios to more desirable ones, possibly in opposition to the activities of the other participants.

the local game: The chilling of the boundary conditions of a local game or games at each of these scenarios in which, while being aware of the potentially altering validity of the scenario (and hence the boundary conditions) a negotiation or other game-theoretic procedure is carried out which is of a smaller dimension than the overall game by virtue of its boundary conditions being held firm.

the transition game: A closure of the overall representation in which the validity of the boundary conditions of the local game are brought into question inducing a desire to disengage from the local game and to re-engage in the scenario game either by making another move in the existing game or by redefining the original game in the light of changed objectives or understanding of the structure of the scenario game.

Metagames and foveal games

Figures 15 and 20, with the above understanding now take on the appearance of a board game, on which the players are allowed certain moves and attempt to move a marker (indicating the present scenario). In this respect we can view Figures 15 and 20 as extensions to metagame graphs, albeit underwritten by a more effective generative structure. In moving between these scenarios, some players will have a high degree of control over the transition, some will have little, but in turn will have more influence in another part of the 'board'. Time enters into the equation, too, so that two apparently similar scenarios are rendered different because of the passage of time, and the likely resultant changes in the balance of control which each player has over a particular transition.

To the extent that a player can control transitions from desirable to undesirable scenarios, he will control the state of the game.

It should also be noted that this concept of a topological game played on a state transition graph allows potentially the concept of a game whose pay-offs are not terminal, but are merely statements of the present state of play. In a practical business situation the terminal payoff for the total activity of a company is considered but rarely; in practice some limited horizon is set at which the condition of the company is forecast and the decisions are made to maximise that expectation. A terminal payoff would constitute managing the company to winding-up or sell-off.

Relationship to Strategic\Tactical Levels

Figure 16 above illustrates that the strategic freedom of a company is limited by the lower levels of its operation just as much as it constrains them. To put it bluntly, having a twenty year strategy is only sensible if you can survive for the first twelve months.

Each scenario in which the company actually finds itself represents a temporary stasis of the boundary conditions for the level below, and in turn, this level could be considered a microcosm of the level above, but with the boundary conditions set at the strategic level.

See Figure 21.

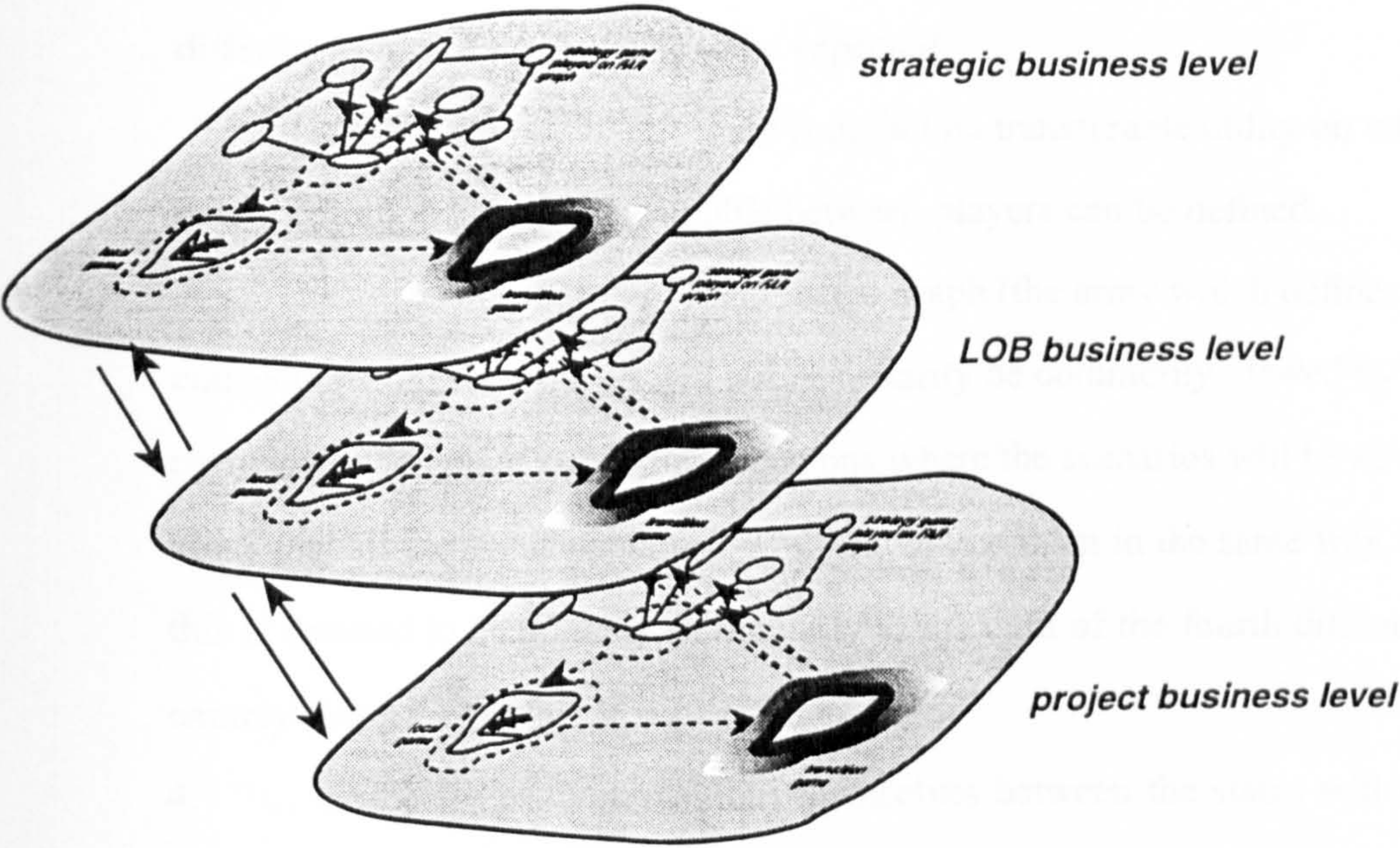


Figure 21: The layering of corporate strategic plans can be considered as a series of foveal game structures.

Similarly at the project level, the scenario in which the project decisions are made is determined and temporarily set constant by considerations at the level above. This is not to say that the decision makers at any one level are unobservant of possible changes of the boundary conditions. Far from it; an awareness of the likelihood of their changing is a characteristic of many of the best decision makers, it is simply that a reduction in the dimensionality of a problem is a frequently used relaxation method for complex problems. An analogy can be drawn from control theory where the effectiveness of a control can be increased either by including more state variables or by considering rates of change of existing state variables in the control law (Singh, 1983). Similarly, a skilled decision maker with a broad view will take into account the rates of change of the scenario determinants as well as internal variables.

Some technical issues

There are certain consequences of a framework such as that proposed, which must be taken into account when addressing the implementation design.

1. The game is unlikely to be zero-sum. The different players will have differing views of the pay-offs to be expected
2. It is always possible that there is in fact no transferable utility on which base a common transaction variable between players can be defined.
3. The adjacency matrix of the directed graph (the array which defines the connections between states) will not necessarily be commonly viewed by the participants. There are of course situations where the scenarios will be so obvious that all the participants will view and define them in the same way, but this is deemed to be unlikely, particularly in the light of the fourth difficulty, namely that...
4. ... the nature of the transitions themselves between the states will not necessarily be commonly viewed by the players
5. There will be no symmetry among players with regard to the power which they each have over the transitions in the game

6. The view of the players about the nature of solution may well be different. In particular the need for a solution to be achieved within a particular time scale may be differently judged by one player compared with another.

When the practical embodiment of such a game is addressed, the following emerge:-

7. The abilities of the players to make the transitions will be derived from a plethora of sources. These transitions will be unrepresentable in the simple terms of cost of transition, or probability of transition. The moves will be ruled by reputation, the need for action, the costs of delay, the personal positions of senior players and many other aspects discussed extensively elsewhere (Chapters 2 and 3).
8. The other players may not necessarily be aware that they are in any kind of game or, in particular in a game that has the generic structural characteristics of the foveal approach. At first glance this would seem to be an advantage, but as Bacharach (1993) shows, ignorance on the part of the other participants can limit one's own freedom of manoeuvre.
9. The knowledge of the parties of the powers of their opponents to induce transitions or to sanction or counter the desired transitions of other parties will not necessarily be held in common.
10. There will be errors in the problem statement itself. For example, it is often the case that the number or natures of the participants will be misunderstood in the initial representation of the problem. Such errors are likely to prove rather difficult to drive out of subsequent, reappraised, problem definitions.
11. The views of the players of what constitutes success in the overall scenario game are likely to change as the game evolves.

When the transition process whereby the scenario game itself is the subject of play is considered, we find that the uncertainties discussed above are multiplied, and in such a way as to threaten the very nature of any mathematical structures which may have pro-

vided the basis for, if not solution, at least signposts to the nature or region of a solution. In the transition game

- 12 the number and definition of the states, the scenarios on which the strategic game is played become the subject of the game itself.
13. The other participants' views of the pay-offs become the subject of the game
14. The connectivity of the strategic game becomes the subject of the transition game
15. The empowerment of the players becomes open to change

Action planning and sensemaking in foveal games

The objective of a strategic conflict management toolset is to produce coherent action plans for interested parties, but as we have seen in Chapter 2, the connections between action planning (essentially ontological intervention) and sensemaking (essentially epistemological intervention) are strong and numerous. The contribution of Habermas's concept of communicative rationality has already been seen to enable a reconciliation of the (different) subjective worlds of participants with an underlying life-world, from which the observable objective world is extracted. Action is then implemented in the objective world and sensemaking is a communication between participants which has the subjective worlds of the participants as its medium of communication. Figure 13 of Chapter 4 above illustrates this.

The variable universe game material of Bacharach (1993), presents an opportunity to use its intellectual framework as a structure on which to base an enquiry procedure as part of the support for the foveal game strategic game. Figure 22 shows the variable universe game concepts (Bacharach, 1993 pp 259-262) from the point of view of a hypothesising structure which attempts to derive the repertoire of the opponents (their potential actions) from their implemented action set and vice versa.

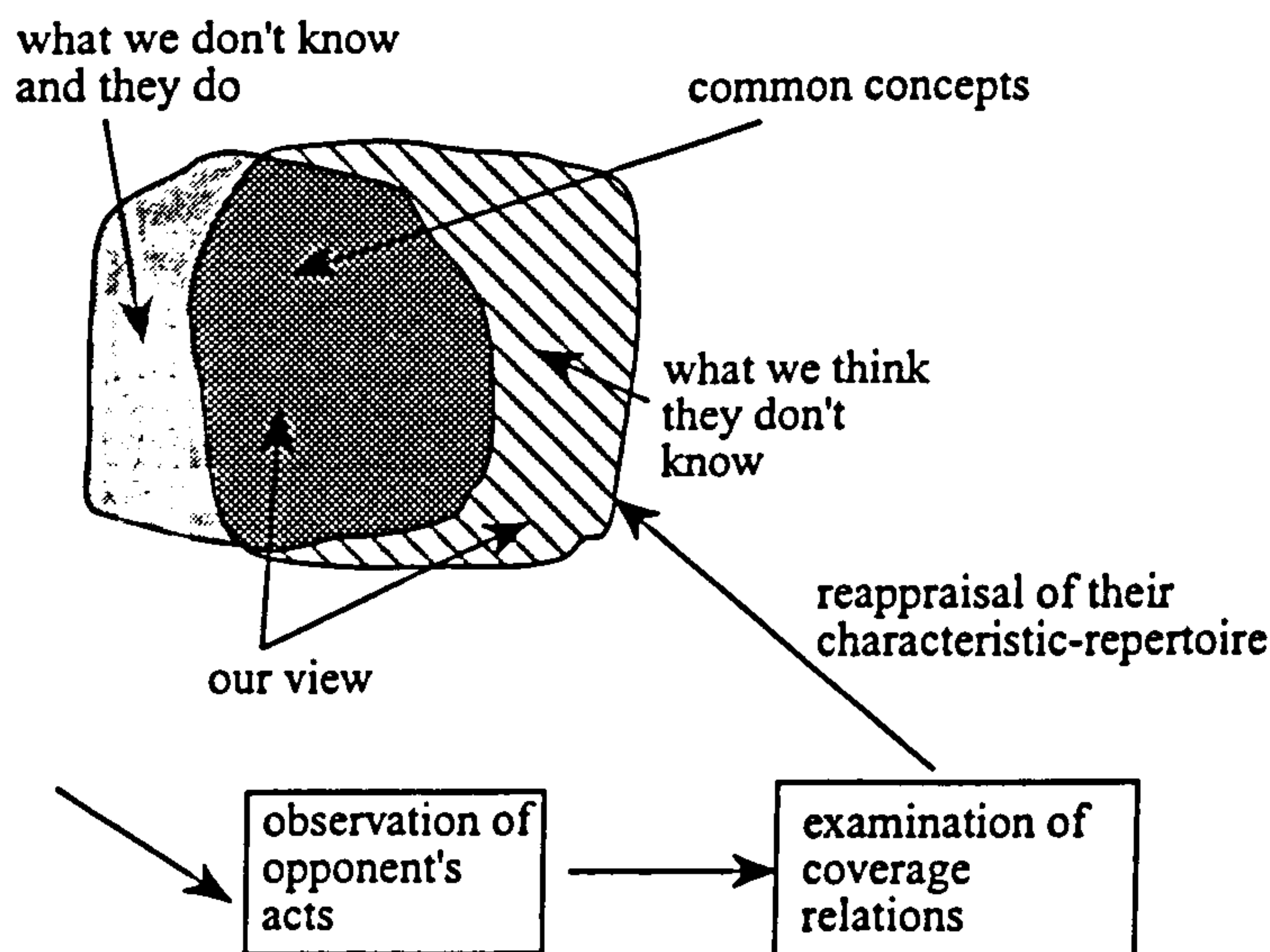


Figure 22: Interpretation of Bacharach's Variable Universe Games as a mapping of subjective world-views

Writers as far apart in their disciplines as behavioural psychologists (Varela, 1995) and management scientists (Quinn, 1978, 1980; Quinn, Mintzberg et al, 1988; Quinn, Mills et al, 1992) all advocate a predictive approach and model of perception. In particular new models of the visual system of the eye and visual cortex show a mechanism based not on the traditional view of the eye presenting an image which the visual cortex then processes and represents to the brain as a objects, but rather the reverse, whereby the visual cortex presents to the eye a set of *a priori* models of what it is expected to see. The eye/nerve intermediate processing then confirms or denies the presence of the expected object. Similarly, the logical incrementalist approach of Quinn (1978, 1987), coupled with the more loosely expressed weak signal analysis of Ansoff (1975, 1988) all present observation of the outside world as an interpretation rather than as an observation without priors. In other words, understanding of the environment comes from a recursion process starting from priors and converging towards a model of the environment which is asymptotically valid to the evidence.

Let us put this in another vocabulary, that of Bacharach (1993). We start with our own

assumptions of the characteristics (those attributes by which we judge and describe the environment). Our own action repertoire emerges from the process of Figure 22, as does, *pari passu*, our repertoire of characteristics, from which the former is obtained by application of the availability function. Of course we know little of this; we have no wider knowledge of the universe of characteristics than our own understanding; what does not occur to us does not exist. Nevertheless we can admit of a wider repertoire of characteristics and hence of actions that the opponents might have, but which we cannot conceive of. Similarly, their repertoire of actions may in fact be limited because of defective understanding on their part which is represented by the absence of components in our own model. There is, of course, a symmetrical set of views from each of the other participants points of view. At the first stage, then, we have achieved as much as can be done with the information available. This information consists of our widest reaching set of characteristics and our most imaginative view of the repertoire of characteristics of the opponents. We can carry out at least one other check using Bacharach's model, namely to conceive separately of the opponents' action repertoire and check that each element of the action repertoire has a corresponding characteristic (via the coverage relations). We will therefore have an epistemically self-consistent set of pairs of action- and characteristic-repertoires.

It will now be clear that as the actions of the opponents become visible to us some may fall outwith the perceived action repertoire attributed *a priori* to them. These will be of two types. First, an action may reveal that the opponent did in fact share a member of the characteristic-repertoire which we had erroneously denied him. Second, the opponent's or opponents' actions may reveal that there is a lacuna in our own repertoires of characteristics, and this would allow a reappraisal of the same to take place.

While no claim is made here regarding the stability of such a process, particularly as the opponent may engage in deception, such a process would have the benefit of disciplining our modelling and perception process of the outside world by providing an algorithm for self and external examination.

What should be expected then, is that the process of modelling in the foveal game struc-

ture should be iterative, with successive passes through the modelling process resulting in both action planning and in sensemaking. The Habermas communicative rationality arguments indicate that there should be no expectation of action and sensemaking being separated (Habermas, I, 1981).

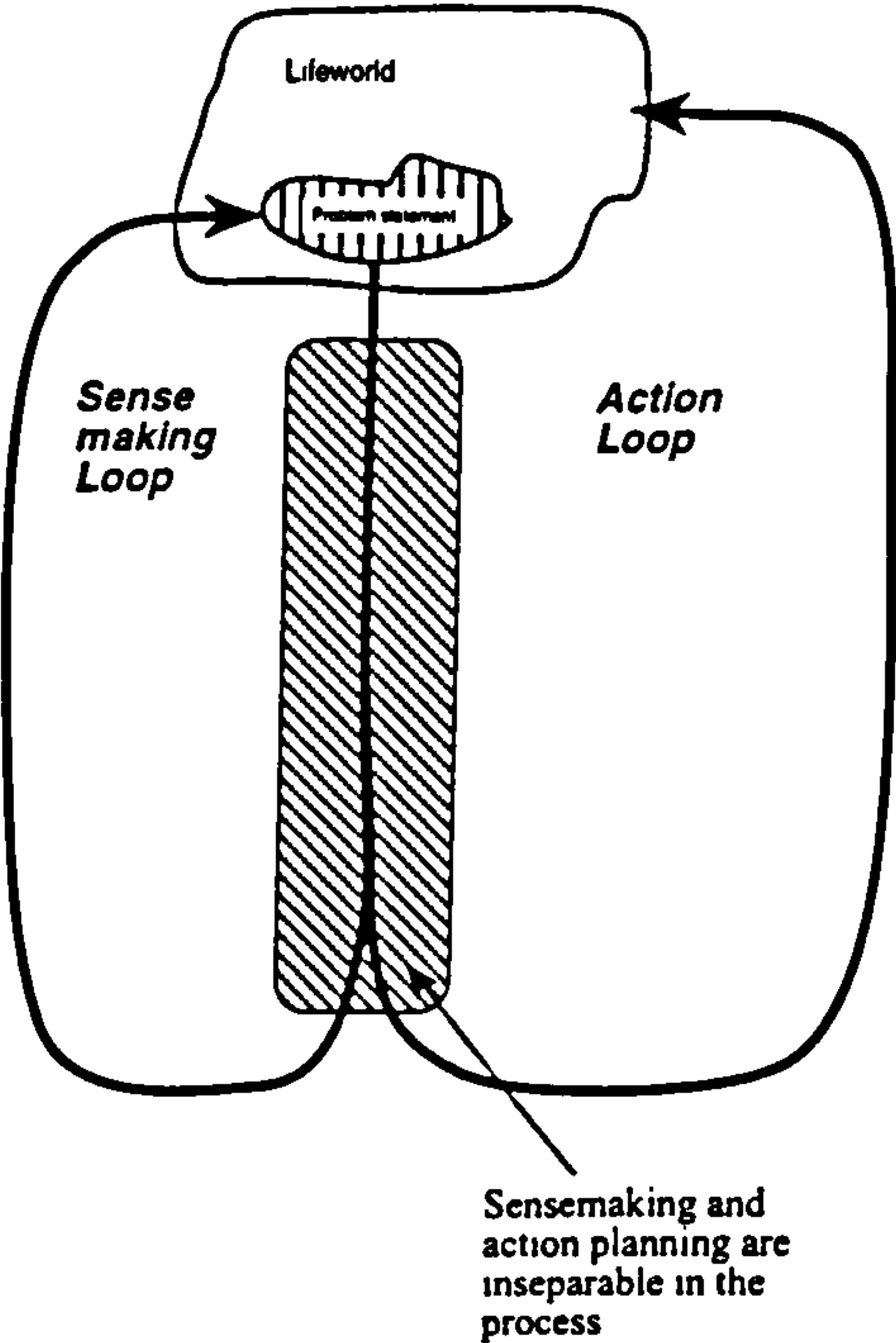


Figure 23: The interaction of sensemaking and action

This interconnectivity is shown in Figure 23, where it can be observed that the action is implemented in the lifeworld and the sensemaking in a subset of that lifeworld which is perceived by the sense maker. The problem situations perceived by the sense makers are subsets of the lifeworld.

We can see this process operating clearly in a number of the case studies which appear below in the discussion of the supporting techniques to foveal games. In particular, in the case study of *The Spanish Mayor* we see an initial examination of a problem situation which results in two separate products. Firstly the client is provoked to take action in the real world to obtain further information and secondly, the process of modelling results in an improved understanding of the problem situation of itself. The situation in *The Spanish Mayor* case study reported in detail below, involves a regional politician who is, poten-

tially being blackmailed. The initial investigation establishes the direction of the threat to the Mayor (from one of the local police chiefs) and induces the Mayor to undertake investigations and put in place certain defensive actions. Quite separately from the action planning and implementation, however, the initial examination shows potential differences in the development of the situation according to whether the Mayor himself exposes the evidence on which basis he may be blackmailed, or whether an opponent does so. We thus see two quite separate products from a single pass of the foveal game process as illustrated in Figure 23, namely action planning to protect the Mayor from the threat and an increased understanding of the potential of the situation. The result of this in the real-life situation of *The Spanish Mayor* was to provoke a second pass of the foveal game process, based on this improved understanding but recognising the effect of action planned in the first pass, action which had changed the actual problem situation.

Chapter 6: The strategic graph - EFAR

Introduction

From the previous chapter it can be seen that the first step for conflict representation and analysis is the production of a strategic graph. This is a directed graph which details the relevant feasible futures for the subject organisation and the transitions which are possible between these futures. The general method for the generation of these strategic graphs used here (Powell & Coyle, 1997; Powell, 1997) is based on the work of Rhyne (1974, 1980, 1981). It is known as Extended Field Anomaly Relaxation (EFAR).

A general description of the EFAR method is supported by a case study which illustrates its use to produce a strategic graph (futures network) for the major UK defence contractor, BAe, just after it had failed to win a bidding battle for the submarine builder VSEL. A second case study which deals with the competitive environment for a medium-sized media company, Oxford Scientific Films Ltd. can be found in Chapter 10, where it forms part of an overall foveal game approach to the strategic problems of that company, showing how the overall strategic graph produced by EFAR leads to the boundary setting of conflict analysis at the decision locale level.

General description

The Field Anomaly Relaxation (FAR) method (Rhyne, 1974; Coyle, Crawshay and Sutton, 1994) represents the future by declaring a number of sectors (or fields) which take discrete and often arbitrarily defined values. The combined status of the sectors then characterises the state of the system under question — they form discrete-valued state variables. Certain combinations of these state variables are mutually incompatible and any selection of values from the set of state variables which contain mutually incompatible values are rejected as representing infeasible states of nature. The remaining (feasible) combinations then each represent a future scenario (or state) and the scenarios together comprise the set of all possible futures to which the system could move. The terms scenario and state are

interchangeable in this chapter. In a business application, for example, the state of the environment may be characterised by such things as share price, capability and market conditions. Each of these sectors have their possible values defined, and as a result it is theoretically feasible to examine all the possible combinations of states which the sector values could adopt. In practice, of course, with any realistic number of sector descriptions and sector values, there results a very large and unwieldy set of possibilities, so that filtering has to take place.

This filtering in the original FAR approach is carried out by a pair by pair examination of possible sector values. For example, it might be judged that the likelihood of the customer confidence being very high while the company's ability to govern risk is very low are mutually incompatible, and so all possible combinations of states which contain this pairing would be rejected. Generally speaking this procedure rejects large numbers of states very quickly. It is then followed by an assessment of each state as a whole; certain combinations of pairs of sectors values may be reasonable, but when put together, produce a scenario which is not sensible.

In the method applied here the FAR approach is adjusted in the detail of its filtering, but the essence of the method remains the same: characterising sectors are defined and examined for reasonableness, the remaining feasible states then constitute the scenarios to which the system under consideration may move. A clustering process is then applied which simplifies the set of states and which allows the incorporation of experiential information from the business user. For example, the businessman may decide that certain states are effectively indistinguishable one from the other and they are then grouped together as one.

It is at this stage, however where the method departs from the procedure used by Rhyne and others. Having established the set of feasible and possible futures the possibility of all possible transitions between states are explicitly examined. A transition matrix is then produced, which is subject to the same type of business judgements as were applied to the clustering of states, and a network results which shows the possible futures and the feasi-

bility of moving from one state to another. In mathematical terms it is a directed graph.

The output of the analysis is fundamentally different from the conventional FAR output in that in the latter the states are arranged into a tree form, whereby no backtracking is deemed possible. Because of the nature of the business problem and the way in which the sector characteristics are defined, the output of the extended FAR (EFAR) is a network of scenarios, where the environment can recover to previous states. Whereas Rhyne's (1974, 1981) FAR tree represents successfully the development of the possible futures, say, of a region of the world in political terms (Coyle and McGlone, 1997) or of a military context, the network representation more effectively represents the movement of companies within that business context. It allows the more dynamic nature of such systems to be represented. It also allows the specific analysis of the transitions which are possible between states. These transitions represent the activities in which the companies can engage in order to exert their will, in bringing about situations desirable from their point of view or in thwarting the ambitions of others. It is this latter potential and the focusing which it induces in the planning and action elements of strategic decision making which provides the greatest motivation for the application of the method in business problems.

In summary, then, the method applied here requires the user to

- a) Define those characteristics of the environment which are significant. There should be around half a dozen of them. The set of characteristics, known as sectors (or fields) should be such that if the status of each is defined the set of values would constitute an adequate description of the 'state of nature'.
- b) For each sector define the values which the descriptor could take. There should be around half a dozen values.
- c) Examine each pair of sectors in turn and determine what valid combinations exist for the sector values.

d) Examine the remaining combinations and cluster them into similarly characterised scenarios or states.

At this point the extension to the FAR method is applied, requiring the user to

e) Determine which transitions between states are possible and express them in a matrix.

f) Apply business judgment to the resultant transition diagram to simplify the topology of the graph.

g) Determine the essential characteristics of these transitions and express them in plain language.

This is illustrated in the flow chart of Figure 24.

The case study which immediately follows illustrates the method in practice and clarifies the procedure by example.

Case Study - BAe's Alternate Naval Strategy

Background

In late 1994 BAe declared an interest in acquiring VSEL, the Barrow-in-Furness submarine manufacturer, primarily as part of its pursuit of naval prime contract business, but, secondarily, (in a largely opportunistic fashion), for purely financial purposes. In particular VSEL presented a ready means of BAe's acquiring an immediate position as the prime contractor of nuclear submarines for the Royal Navy and for the provision of hulls and associated system solutions overseas. At first it was thought that GEC would be neutral in the matter, but it soon became apparent that they had had second thoughts to the extent that they entered the fray with a bid which was higher in cash terms, but not immediately higher in equivalent value (because the BAe offer was expressed in terms of its shares). The matter was referred to the Monopolies and Mergers Commission, who, in May 1995, had their opinion expressed by the then President of the Board of Trade, Mr. Michael

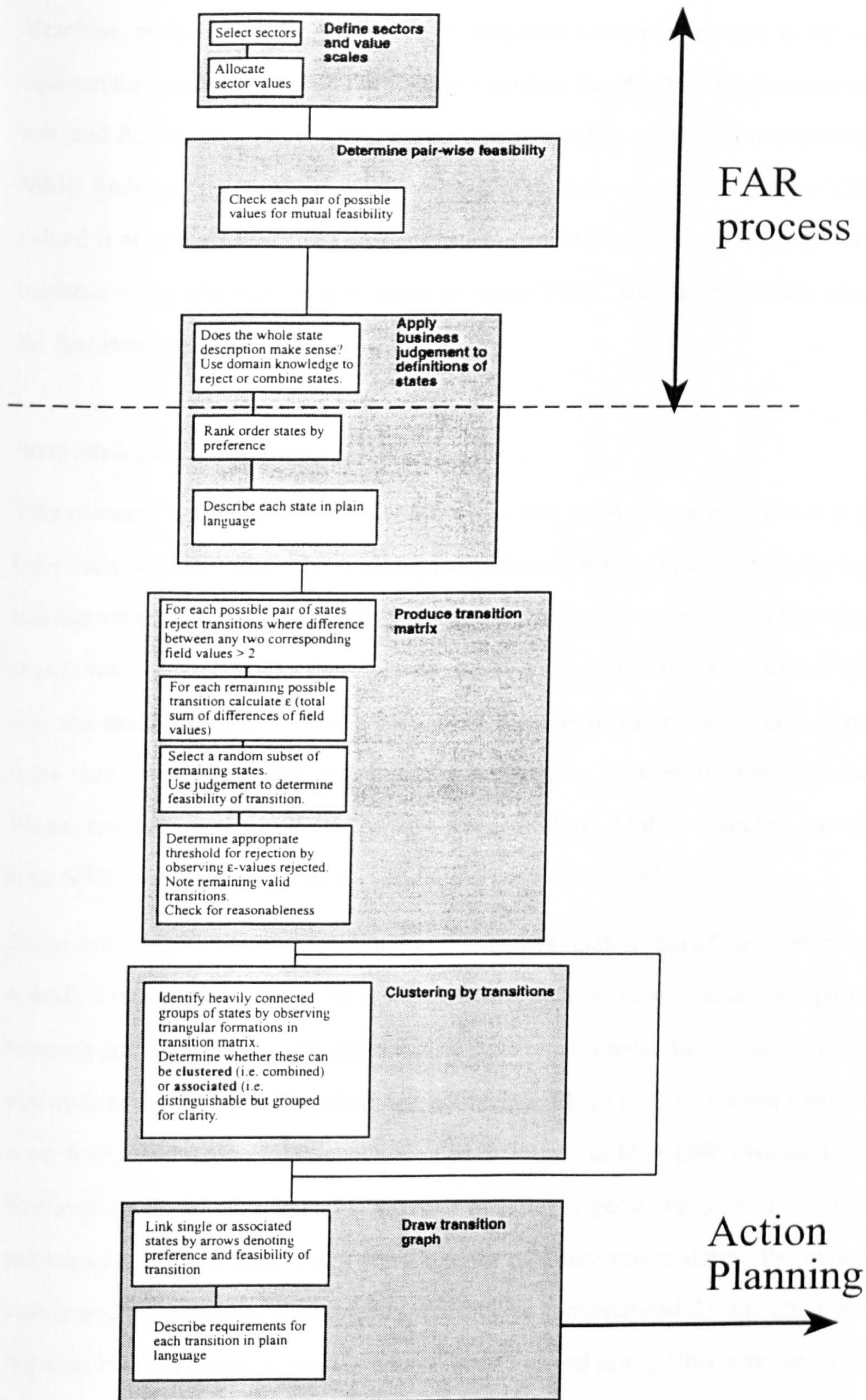


Figure 24: The EFAR procedure

Heseltine, as favouring the proceeding of both bids without constraint. It was understood that certain undertakings had been made regarding the effect on employment in the Barrow and Scotstoun areas if GEC were to be allowed to proceed. On publication of the MMC findings GEC made a substantial and ultimately successful offer for VSEL which valued it at around £800m. BAe then had to decide on an overall strategy for its naval business in the aftermath of this failure to secure VSEL, and this case study was the basis for that strategic plan.

Methodological background

This research was carried out while the writer was a BAe Research Fellow at Cranfield University. Shortly before, the company had planned for and ultimately failed to buy VSEL, and the writer had been intimately involved in the precursor activity to that bid. The research was initiated by the then Planning and Strategy Director, Mrs. Alison Wood who was the main informant, under a participative action research framework. In particular, there was a very close and open business relationship between the researcher and Mrs. Wood, not least because of the previous responsibilities of the researcher, namely as the BAe SSD director responsible for the submarine business of BAe.

There was, thus, little concern about the participative relationship of the researcher, and no special considerations had to be made to ensure that the requirements of a participative research posture were met. On the contrary, there remain some minor commercially sensitive options for the company which are not recorded here (as they remain live), but these were freely discussed in the intervention environment in May 1995 (Wood, 1995). This free availability of commercially sensitive material is good evidence of an appropriate participative environment. There were a series of interventions during the period of research and the meetings were directly recorded as computerised documents, from which this case study is drawn. It was not appropriate to record in any other way; tape recording, for example, would not have been acceptable to the client.

The security considerations of the research at the time were most stringent. No discussion could be entered into at the time other than with Mrs. Wood and her immediate subordinate, Mrs. Liz Batchelor. The latter, however, provided a useful and stringent examination function of the working documents.

Define the sectors

Table 11 shows the sector and value array worked out between the researcher and Mrs. Wood in 1995. The acronym SOARCE is used to tag each field value for reference.

The field values were described as follows:-

Share Price (S)

It was felt that a drop in the share price below £4-00 would constitute sufficient of a crisis as to change the environment in which strategic decisions would be made after a GEC buy of VSEL. Similarly a share price above £6-00 would represent an inherent capacity in the company great enough to allow significantly changed objectives if these were desired.

Extent of Objectives (O)

The range of objectives ranged from mere survival, through a limitation of company objectives by 'lopping limbs' through the execution of an essentially incremental policy and ultimately to extensive ambitions of European and global domination of the defence markets. The present state was value 5 where it was felt that with the evidence of the company's ambitions towards VSEL and its European activities, primarily in Joint Venture company setups, it was appropriate to describe the company's ambitions as significant, but falling short of immediate European dominance.

Internal View of Abilities (A)

The actual capability of the company to carry out the strategic intent is clearly of great importance in the description of the environment.

Risk on contracts (R)

It was felt intuitively that the performance of the company in this particular area would be of singular importance in characterising the business environment for it. There is a strong and obvious degree of correlation between customer confidence and ability to manage risk.

External Credibility (C)

This sector is primarily aimed at expressing the confidence which the customer (UK or overseas) feels about the ability of the company. It is not solely related to ability and performance, since other factors, such as strategic industrial issues and personal credibility also enter the equation.

Procurement Environment (E)

This could profitably receive a study in its own right, encompassing the economic and political factors which may change over the next five years, but we are restricted here to statements about the general accessibility of the market by defence contractors, and BAe in particular. As the risk management capability of the contractor falls, its ability to access the market will also fall.

It can be seen that the sector values form a mixture of internal attributes [Extent of Objectives], [Internal View of Capabilities] and external attributes, [Procurement Environment] and [External Credibility]. Similarly, some variables are directly controllable by the company [Extent of Objectives] whereas others are only indirectly controlled by the company, such as [Share Price].

Define sector value scales

Table 11, again, shows that each sector has assigned to it a range of values. It is the combination of values for all the sectors which describe the state of the situation under examination. Thus $S_2O_1A_2R_2C_3E_2$ would represent a future situation where the company has a share price around £4, is concerned only with its survival, rather than with any development, and has the view that its performance is below what is needed for success, etc..

Determine feasible states

The next step in the procedure is to identify all the states which are internally feasible in the sense that the combination of values for the sectors represents a possible situation. Clearly, some combinations are not mutually compatible; if the share price is very low, a competent management is unlikely to engage in a strategy involving domination of a new market with high entry barriers and powerful incumbents, for example. The process of determining mutual feasibility is straightforward. Each pair of states is taken in turn and the feasibility of the sector values being compatible is considered. This leads to the pair-wise compatibility array of Table 12.

Each column of Table 12 corresponds to a sector, with each possible value which the sector can take written in bold below it. Thus S can take the values 1 to 5 and R can take the values 1 to 6. For each value of each sector the feasible values of the other sectors are written out, while infeasible values, i.e. values of other sectors which are not compatible with the value of the sector under consideration, are replaced by a dash. Thus, if S has the value 4, O can only take the values 4 or 5; A can only take the values 2,3 or 4; R can only take the values 4 or 5 and so on. Similarly, if R has the value 2, then C can only take the values 1 or 2, and E can only take the values 1,2 or 3.

These feasibilities are judged entirely on the basis of the business judgement of the client and represent a significant input of business knowledge into the model.

The admissible combinations of Table 12 are applied in a cascade fashion resulting in a set of feasible combinations of sector values which complies with each of the constraints of that table. This results in 108 possible future states, a substantial reduction from the 31500 possible states at the start of the process. These states are defined in Annex A of this work both in terms of the combinations of sector values and using pen-pictures summarizing the reality of the state in the business world.

This relatively long list of states is now examined, by clients' representatives with adequate knowledge of the business problem and context, in order to reject states which,

S	O	A	R	C	E
1	123---	1234-	1234--	123---	1234-
2	-234---	1234-	-234--	-234--	1234-
3	--345--	-234-	--34--	--34--	-234-
4	---45--	-234-	---45-	--345-	--345
5	---4567	--345	---456	--3456	--345

1	12---	123---	12---	12---
2	12---	123---	12---	12---
3	-234-	-234--	-23---	123--
4	-234-	-234--	--34--	-23--
5	--34-	---45-	--345-	-234-
6	---45	---456	---45-	-2345
7	---45	---56	---56	-2345

1	12---	12---	12345
2	-23---	-23---	12345
3	---4-	--3---	12345
4	---45--	--34--	12345
5	---56	---56	12345

1	1----	12---
2	12---	123--
3	123---	1234-
4	23---	-2345
5	--345-	--345
6	--3456	--345

1	12---
2	12---
3	1234-
4	12345
5	12345
6	12345

Table 12: Compatibility matrix for BAe's alternate naval strategy

although compatible on a pairwise basis, made little sense in business terms as a whole.

This process of combination and rejection resulted, in this example, in a set of 41 states.

Clustering of States

Examination of the remaining states at this stage often results in the client observing that in practice a number of states are indistinguishable one from the other. This often results from a new understanding that under certain conditions sector values can merge one into the other. For example, if development funds were freely available to a company, the accessibility of the market, expressed as the value of the sector [market accessibility] might be rather important, because the exploitative possibilities would be limited by that accessibility. If on the other hand there were no development funds available, the accessibility of the market might well be judged irrelevant because no exploitation could take place for reasons other than the value of the hypothetical sector [market accessibility].

In the illustrative BAe example this process of clustering resulted in a reduction in the number of feasible states from 41 to 32.

It is convenient at this point to arrange the remaining states in order of preference to the client company. This is generally a straightforward process since it is aided by the characteristics of the sector\value table (Table 11). The sector values have been arranged so that there is a progression from bottom to top, and so that the preferred values are at the top of the columns. This structure allows clients' representatives to identify preferred states by high sector values.

The Transition Matrix

Up to this point, with a few nuances arising from the particular application, the methodology has followed that of Rhyne (1974, 1981). Now, however, the possibilities for transition between all states are considered and expressed in a transition matrix. The process is as follows.

Maximal Difference

Transitions are rejected where the difference between the value for a particular sector is too great between the two states. Here, a transition of more than 2 steps was deemed infeasible. There are issues both of straightforward feasibility and of timescale here. Some transitions can be rejected simply because they cannot take place. Other judgements are more difficult to reject because, for example, the client may observe that it would take too long to move the company's competence from one level to the other if only limited funds are available. While these observations can be tricky to include in theory, practice shows that the time horizon of the problem is usually quite well defined. If the transition in question can be achieved within that timescale it should be included; if not it can be rejected, but should not necessarily be. Ultimately the only loss in including a dubious transition is that of unnecessary complication. This is, in any case, addressed directly in later stages of the process.

ϵ -difference

The ϵ -difference is the sum of the differences between the corresponding sector values of the two states, ignoring the sign. This allows for transitions which require too large an aggregated difference between the states. The technique is to calibrate the value of ϵ above which transitions should be rejected by first considering on an experiential basis which transitions of a subset of those possible transitions are likely to take place. The ϵ -differences of these transitions are noted, and a rough pattern emerges, whereby transitions which had an ϵ -value greater than a certain value (8 in the illustrative example) are unlikely to be judged feasible in business terms. They are then rejected. It would be possible to examine each transition one by one and achieve the same result, but the method described gives a quicker rejection of groups of transitions by noting the transitions rejected (on the basis of business judgement alone) in a subset, and then extrapolating the criterion to the remainder. It provides an indication of which transitions are likely to be rejected in the remainder of the set.

Examination of the feasibility of the transitions results in a matrix whose elements take the value 1 or 0 according to whether a transition is judged feasible or not (Table 13). Graph theory recognises this as a state transition matrix or connectivity matrix (Marshall, 1971; Bondy, 1976). In Table 13 the 0 entries have been suppressed for clarity. We will see later that this identification of the feasibility of transitions between states is the key element in representing the situation under examination since each transition implicitly represents an opportunity for the client company, a competitor or a neutral environment to act so as to change the state of affairs. The transitions represent in real terms the opportunities available for participants to make investments or take other action in order to bring about a more desired state or to thwart the desires of a competitor. If this process of determining the feasible transitions were not to be carried out, the essential structure of the business situation in terms of determining what is or is not possible in practical terms would remain hidden. By explicitly identifying which transitions are possible we both reveal the possibilities for movement and provide, eventually, the basis for action planning in order to bring about those transitions.

Clustering by transitions

It would be possible at this point to draw out the transition matrix as a directed graph, linking states according to the value of the corresponding element of the matrix of Table 13. This results in a rather complex picture which presents no more information than is contained in the matrix. Nevertheless a pictorial presentation is more accessible to senior executives. Clients understandably find that the numbers of transitions and states give a complex picture which seems to reveal less than was expected about the structure of the business situation under examination. The clustering technique allows consolidation of the picture so that the overall future picture and characteristics of transitions can be appreciated. A return can then be made to subsets of the detailed picture implicit in Table 13, as

Table 5 – Transition Matrix (rank ordered by preference)

Table 5 – Transition Matrix (rank ordered by preference)																																
To→																																
From	104	102	98	78	75	73	101	93	106	96	59	70	47	64	57	63	54	45	35	20	10	13	9	8	7	6	19	15	4	3	2	1
104	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
102	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
98	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
78	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
73	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
101	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
93	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
106	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
96	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
59	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
70	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
47	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
64	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
57	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
63	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
54	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
45	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
35	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
19	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Table 13: Transition feasibility matrix for BAe's alternate naval strategy

an example, in order to examine specific development paths.

Fortunately the structure of the transition matrix gives clues as to likely candidates for clustering among states. Generally speaking, when states are densely connected they are likely to form groups which

a) in terms of the readability of a directed graph are conveniently placed near to one another

and

b) in business terms are very frequently members of a set of business situations which, although distinct, can be associated one with the other, so that the businessman will see them as a group of outcomes which he can deal with together, only breaking them apart for single consideration if greater resolution is needed.

This dense connectivity appears in the transition matrix as triangular groups of 1s indicating that adjacent groups of states are connected one with the other. In Table 13 the following sets of states are candidates (among others) for this clustering process.

104+102+98 (notated as 98+)

98+78+75+73 (notated as 73+)

73+101+93 (notated as 73₂+))

93+106+96 (notated as 93+)

47+64+57+63+54+45+35 (notated as 35+)

10+13+9+8+7+6 (notated as 6+)

9+8+7+6+19+15 (notated as 6₂+))

15+4+3+2+1 (notated as 1+)

It will be observed that some states fall into more than one putative cluster. Moreover, it must be stressed here that it is insufficient to rely on the structure of the transition matrix alone to justify the clustering of states. The membership of each state in a proposed cluster must be checked against the business experience of the client. On the basis of these connectivity criteria and by careful consideration of the practical (i.e. real life) differences between the states, the client's representative decided here that an appropriate grouping of states for the purposes of initial display were as follows:-

104 to 70 (notated as **improvement** and representing states considerably more desirable than today)

59 (separately perceived as a state where project performance had been successfully translated into a trading improvement)

57+64+63 (notated as **57+** and representing states in the immediate vicinity of today)

45 (representing the importance of a changing market condition)

35+47) (notated as **35+**)

20

10+13+19 (notated as **10+**)

9

6+7+8 (notated as **6+**)

15+4+3+2+1 (notated as **decline** and representing those undesirable states where the fortunes of the company have become so bad as to be indistinguishable one from the other)

The effect of combining states in this way is to condense the transition matrix to that of Table 14, to which the diagram of figure 25 can be seen to be equivalent. Since the transi-

tions are all bidirectional the transition matrix is symmetrical and only the upper half is shown in Table 14. These clustered states are defined in Annex B to this work.

	To→										
	From	Improve- ment	59	57+	35+	45	20	10+	9	6+	Decline
1	104										
	Improvement	1									
	59		1	1							
	57+			1	1						
	35+				1	1	1	1	1		
	45					1	1	1	1	1	
	20						1				1
	10+							1	1		1
	9								1	1	1
	6+									1	1
	Decline										1

Table 14: Relaxed transition matrix for Case 1 - BAe's alternate naval strategy.

It must be stressed here that in many respects the choice of states to be represented at this initial stage of presentation is subjective. Some client groups may wish to have states in the vicinity of today to be represented. Some may desire only a small degree of clustering while others may wish to have a greatly simplified diagram presented in the first instance. No information is lost in this process so long as the transition matrix of Table 13 or its equivalent is used as the source for further, more detailed, investigations.

Output

The two final stages in the process are to represent the transition matrix in a graph form and to characterise the transitions in a way which relates them directly to the business environment from where they were derived. The resulting transition diagram for the illustrative example appears as Figure 25.

Graphical presentation

Some care is needed in practice in presenting these summary directed graphs to the client, since too rich a representation can result in the essential structure being left out. Two

techniques have proven useful in practice, both of which were applied, as discussed above, to produce Figure 25.

Graphical Representation of Transition Matrix

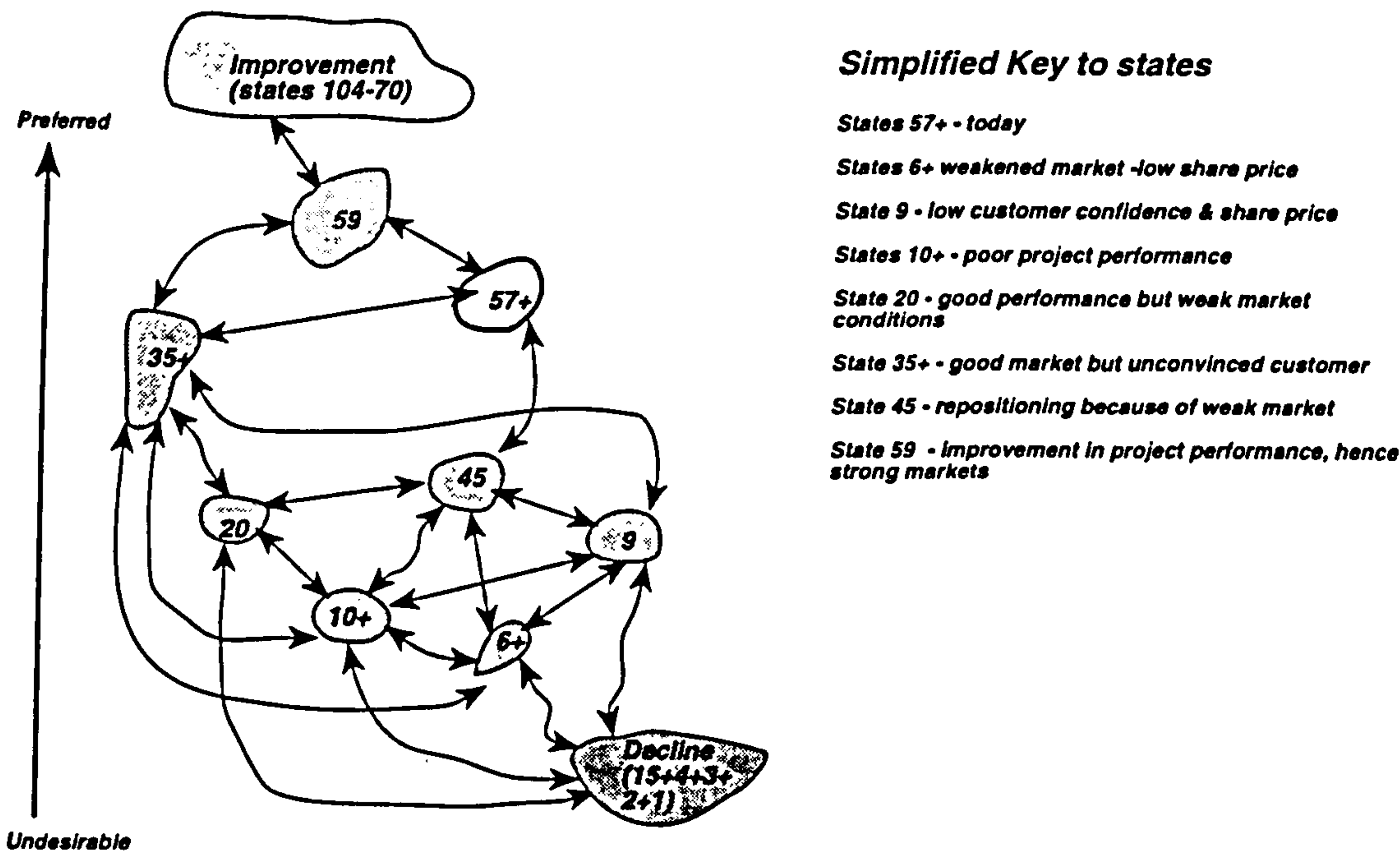


Figure 25: Directed graph (Strategic graph) for BAe's Alternate naval strategy case (corresponding to Table 14)

Firstly, it is often advantageous to limit the graphical representation to the vicinity of today. Then, as planning moves from consideration of the immediate problems facing the organisation to longer term issues, other portions of the graph can be brought into the conversation as necessary.

Secondly, a temporary grouping of the states in order to present a coarse filter of the situation is often advisable. Then, as attention is drawn towards one region of the graph or another, further detail is revealed in that area.

The diagram of Figure 25 exhibits only bidirectional links, but this is not always the case. The vase study in Chapter 10 (OSF's Strategic Future) reports on an application

which shows a relatively complicated output graph, produced using the second technique above, and which has a number of one-way links, representing irreversible business actions.

Transition Analysis

In this application EFAR was aimed primarily at a general strategic sensemaking output, as distinct from a specific conflict analysis. Nevertheless, the diagram of Figure 25 provided some surprising conclusions for the Board of BAe SSD, achieved by an examination of the practical business consequences of each transition and its effect.

Firstly, the 'today' state, 57+, has three states immediately accessible from it, namely

59 where BAe's project performance has improved significantly, and, in the long term, markets have strengthened

35+ where the market has strengthened because of exogenous factors (say, an increase in long term tension) but BAe relative to the other competitors is not convincing the customer either of its commitment, capacity or capability.

45 where the market has weakened, and, in spite of any capability on BAe's part, the trading conditions are not good.

Additionally it was noted that state 45 was critical, in that movement to it would be out-with the control of BAe and that once at state 45, it would take only one step, say in allowing project performance to erode, to place the company at one of the dangerous 'boundary states' only one step away from the disastrous decline states in the bottom right hand corner of the diagram.

At this level of strategic sensemaking, the environment is very broadly drawn, and the moves of the foveal game consist of broad strategies of endeavour. Here the board concentrated on two main issues. First, they considered measures to improve project performance, both as a defensive measure to insure against any uncontrolled movement towards

the states bordering decline, and offensive, in contributing to the desired move towards state 59. Secondly, the board addressed the consequences of their activities in the merger and acquisition market in terms of the confidence with which the customer viewed the company's activities.

In respect of the project performance the effect was to benchmark the competitors' performance in the sector with particular regard to the risk management tools used. This resulted in a significant investment in risk management software, the appointment of two senior risk managers in important project functions, and an increase in responsibility of the commercial director to encompass total risk (commercial and technical). This appears in retrospect to have been a unilateral consideration (*What can we do to improve our project performance?*) but such an interpretation would be erroneous; at the time of the board's consideration the issue was seen clearly to be a struggle for the technical contribution to winning control over the transitions 57+ to 35 and 57+ to 59 in opposition to the project performance of the competitors.

As far as the merger and acquisition considerations were concerned, the diagram provoked an extensive exercise to identify a target for either a major strategic alliance (for example, with DCNI, the French national shipbuilder) or the buy of a smaller shipyard from which project performance in the naval sector could be improved, but, more importantly, which would indicate a degree of commitment to the government that the company was still in the ship business in a significant way. Again, while it may appear to be unilateral planning, it was clearly seen at the time to be an issue over the control of the transition 57+ to 35+.

The merger and acquisition planning became ambushed by the local interests within the naval sector of BAe. In particular, the systems interests of BAeSEMA, the joint venture which aimed at providing the combat and weapon systems for projects, became dominant. Whereas the purchase of VSEL would have meant that BAeSEMA had a dominant and ready-made position as system supplier (since the BAe-VSEL combination would have been formidable in the UK marketplace), a purchase of a smaller company, say VT, the

south coast corvette and small frigate manufacturers would not have placed them in such a dominant market position, and BAeSEMA would prefer, under those circumstances to remain independent. As a result, no purchase was attempted, although initial conversations took place in 1996.

Today's state is effectively state 45, the project performance of BAeSEMA, while good enough to sustain a good revenue stream for BAeSEMA has not proved good enough to provide a platform for BAe back into naval prime contractorship. Additionally, the ship market in UK has remained stagnant. Fortunately for BAe as a whole, their overall project (non-naval) capability has allowed a substantial share price increase to take place, making the need for naval prime contractorship wane.

Practical considerations and observations

General considerations of intervention practice are covered elsewhere. In both the case study described here and in *OSF's Strategic Future* study of Chapter 10 an approach of participative action research was adopted. The EFAR process appears natural for the client. Since it starts from an examination of the important attributes of the future, clients' representatives feel that they are in control of the process, and, since the detailed manipulation of the states clearly requires knowledge of the real business dynamics, this feeling of engagement is maintained throughout the process.

Difficulties can occur if the client organisation is represented by more than one person, since different functions might have different valuations of objectives. Far from presenting difficulties these debates serve to clarify the futures of the organisation by argument. Difficulties would occur if the different representatives retained conflicting views of the value of objectives, but this has not yet been observed in practice. *In extremis* parallel analyses could be carried out to represent the different viewpoints.

Selection of sectors and values

In practice it has sometimes proved difficult for the client to select appropriate sector values. For example the client will sometimes fixate on one particular aspect of the future and offer a number of sectors which are so closely connected as to be indistinguishable. [Share price] and [Market capitalisation] might be examples. Sometimes, on the other hand, the state of the company is perceived in a very complex and rich way, so that the selection of a small number of defining characteristics is felt to be restricting. Because of the very large numbers of possible states which can arise it is essential to keep the number of sectors down to around seven, as advised by Rhyne (1981), and in order to assist in this three observations need to be made to the client.

First, the fact that later in the process the interactions between and among the sectors are examined in great detail means that many of the interactions between the characteristics, which tend to be very much in the forefront of the mind of the client, can be examined and included in the representation. At the beginning of the process clients tend to think of the sectors as being independent characteristics of the business, which gives a false view of the complexity of the underlying model.

Second, the adequacy of the sector choice can be tested by asking the client to imagine, say, reporting to shareholders in the Annual Report on the state of the business or to their superiors on the state of a project or market sector. Generally speaking the sector values will be represented in the (implicit) headings used in a report. This approach seems to defuse the worries often expressed that the state of the business cannot be expressed by a mere six or seven attributes.

Third, the process becomes grounded with respect to the true business environment because the descriptions of the states and the transitions provided at the end of the process come directly from the domain knowledge of the sub-

ject company's representatives (as opposed to the technique itself or the analyst).

The check on the adequacy of the sector values, the scale within each sector, is more intuitive. The originating executive is asked to imagine a business decision which might have to be made within the future context and is asked to think whether the degree of definition of the field value would be sufficient to determine the context. Although this appears an arbitrary and subjective way of assessing the sensitivity of the scales in each field, in practice it proves entirely adequate, and, moreover provides direct cognitive rehearsal of the eventual application of the output of the EFAR context study.

Compatibility of Field Values

The process of determining which field values are pairwise compatible is largely a subjective one. It is important that the informant and researcher do not attempt to 'second guess' the collective consequences of the filtering process. Attention should be restricted to the particular pair of field values in hand.

Clustering process

The key to the state clustering process is to imagine in business terms what constitutes then important characteristic of the group of candidate states. Frequently the value of one particular sector will dominate the business. For example, if the availability of operation funds is so low as to be insufficient to retain the existing organisation, the nuances of customer confidence will be of minor importance, so that the effective business view is that of a cash-starved operation. We see this strongly in the OSF case study, where the share holding issue dominates the strategic multi-futures view. This is not to say that the underlying structure of states is insensitive to organisational posture, for example, or competitive pressure, but merely that the share holding, *ex post*, is seen to be the catalyst for all business progress, and hence dominates the perception of the future.

Transition Analysis

Practice shows that the filling in of the transition matrix is time consuming and wearisome. This can be avoided to some degree by assiduous clustering at the previous stage. Secondly, there are often patterns which emerge from consideration of the business realities behind the state definitions.

The clustering process at the transition analysis stage is aided by the two techniques described in the case studies, whereby the effective distance between the states is a cue for whether they are likely to be connected or not. Generally speaking if the definition (as expressed in the state 'words') of the two states are far apart it is unlikely that the two states will be connected. Ultimately, however, business judgement will prevail.

Graphical Presentation

In both case studies, and indeed in others not reported specifically here, the diagrammatic output can be produced within a reasonable time and with a level of contribution acceptable to the principals of companies. In the OSF case, reported as a whole in Chapter 10, the process took some three weeks to complete, with an initial meeting and two interim meetings with the owner to inject detailed domain experience. Each meeting took two to three hours. Other applications show similar patterns. The final, debriefing meeting took about two hours. The effort away from the company amounted to some four man-days work.

The strategic graphs can appear daunting to some audiences, with a mass of connections linking an indigestible mass of states. A successful technique is to focus on one of the sectors (as in the OSF case, Figure 56 of Chapter 10) in order to fix the business situation underlying the structure of the states in the minds of the audience. By successive simplifications an understanding of the collective strategic graph is usually achieved. The number of connections between states can also be difficult to digest. A plethora of connections is sometimes an indication of a less than careful clustering at the transition clustering stage or of a less than discriminating judgement as to which transitions are feasible. In the

absence of these two failure mechanisms, a good approach is to divide the strategic graph up into three connected diagrams which cover source states (those which originate arrows), sink or receiver states (which receive arrows) and internal structures within groups of states. The first of these are illustrated in the OSF case (Figures 58 and 59).

Lastly, the analyst must remain flexible in terms of the display of the final network. It would be erroneous to think that there is a single acceptable presentation method for a complex future scene, and a certain originality is often appropriate in seeking ways to present the often complex networks which can result. In the case of OSF, the focusing effect of the realisation that the real problem was not that of organisation but of ownership allowed a wholesale simplification of the network as shown above.

Action Planning analysis

The action planning process also appears naturally from consideration of the output diagrams by the clients' representatives. The structure of the network approach lends itself to a disciplined, procedural approach to those executives seeking completeness in their planning, while the ability to look far into the future attracts those of a more intuitive nature. Essentially there are three approaches to the generation of action planning from the strategic graph.

General analysis

As can be seen in the case studies, the EFAR output can be seen as providing nothing more than an improved perception of the development process in which the client organisation sits. No particular effort is made to analyse the competitors' powers in controlling the transitions. The strategic graph is used merely to cue the management in to those issues which, in a general sense affect the future of the company. To the extent that the company's unilateral actions can condition that future, then the desired future or futures will be reached. We see this style of planning in the OSF case where the conclusion from the EFAR analysis is that the company's share structure must be drastically altered. Al-

though implicitly this involves a third party (a prospective buyer) it is not necessary to be specific about that third party. In fact, the very next step in the OSF analysis was to draw up with the owner's advisers (Coopers & Lybrand) a list of potential buyers, so that the transition from strategic graph to decision locale was made quickly.

Functional Analysis

The successive viewpoint which the different functions of a company can and do take to strategic planning can form the basis for a planning checklist for action planning. Here successive viewpoints are adopted from, say, IS, human resources, or marketing in order to answer the question, What can the function do of itself to further transitions which are desired. An example of this can be seen in (Munro, 1996) where the method is applied to the information strategy of a government design support organisation. Functional analysis, however, still takes essentially a unilateral viewpoint.

Competitor-based transition analysis

More in keeping with the origins of EFAR as a strategic graph production method is the approach whereby the abilities of the competitors and the client company to control the transition is taken into account. This is seen in the BAe case, where the effect of the competitors' project effectiveness is seen to attenuate the transition from state 57+ to state 35 because the competitors' effectiveness in project terms is seen to re-norm the customer's expectations. The essence of the approach is to examine exhaustively the methods by which interested parties are able to influence the transitions which we wish to avoid or wish to promote. It is then straightforward to generate an output similar to that of case study one, where the requirements to defend or promote particular transitions are combined into an overall action plan.

How effective is EFAR?

Further to the discussion of Chapter 5 (Figure 23) EFAR is to be judged in two separate respects, namely its ability to make sense of the environment and its ability to generate effective action planning. There is no recourse to any single truth under the constructivist paradigm adopted in the argument of Chapter 4. We have no greater confidence in our retrospective judgement of the veracity of the EFAR-derived view than we do in our contemporary judgement during the analysis. In the later case we are in danger of burdening the model with judgements based on theories and data deriving from subsequent analysis; in the contemporary case our judgement of its behaviour in comparison with 'the true situation' is defective in a number of ways. First, our definition of the system in focus is constructed in a time frame and with a set of preconceptions which are only partly declared even to ourselves. Secondly, that view of 'the truth' is made from our own viewpoint; there is no guarantee that another's contemporary viewpoint will not be equally valid. The approach to justification, then is to enquire as to the effectiveness of the method in respect of its sensemaking and action planning techniques at the time of analysis as judged by the participants.

In the example of the BAe case the judgement of the strategy and planning director was that the method and analysis produced a different understanding of the position of the company in its time-process. In particular, the observed reaction of the divisional board to whom the strategic graph of Figure 25 was presented was one of surprise and clear concern that the company was apparently only a short distance away from the discomfort of the states marked decline. The direct result of the briefing to the board was the setting in train of two new initiatives

- a) an investigation and subsequent in risk management techniques for project management and
- b) an analysis of takeover options amongst the remaining community of naval contractors, and in particular the smaller UK shipyards.

The evidence of a tangible investment in risk management tools as direct result of this new perception and of the subsequent activities of the company in approaching other strategic targets to maintain their position in the sector shows that the multi-futures approach did indeed improve the understanding of the managers in question of their situation.

Chapter 7: The Management of Specific Conflict - Powergraph

Introduction

The strategic directed graphs resulting from the application of EFAR present competent solutions to the problem of overall strategic planning, but, generally speaking, do not offer sufficient detail to then allow the management of specific conflict situations. In order to address such matters a technique (known as Powergraph) is described which allows the representation of the specific options open to participants. It is an embodiment of the local game described in Chapter 5 and, as in Figure 13 above, can be considered as a subset of the overall strategic game. In Chapter 10, which deals with the practice of foveal game analysis, a case study (Oxford Scientific Films) is reported which illustrates clearly the connection between the strategic directed graph and the Powergraph analysis at the local game level.

The applications addressed in this chapter are chosen primarily to illustrate the technique of application of the method. They consist of an *ex post* study of a simple military/political situation from the 5th century BC, chosen because of its non-contentious nature to illustrate the method, an *ex post* study of a struggle between three UK defence companies for two major naval projects, chosen because of the clarity of its tactical conclusions *vis-a-vis* the actual behaviour of the participants, and a set of examples where Powergraph is applied to some classical game theory problems, chosen both to illustrate the ability of Powergraph to improve upon the classical solutions and to provide examples of analysis heuristics. Later case studies, including the analysis of the 1937 *Postage Stamp Crisis* between Nicaragua and Honduras provide further examples of analysis (in Chapter 8), as do subsequent studies of a blackmail situation (*The Spanish Mayor*), a struggle over the staffing of an international project (*BAe's Staffing Problem*) (both in Chapter 9) and the disposal of a company (*OSF's Strategic Future*) (in Chapter 10). The last of these serves also to illustrate the connection in practice between EFAR and Powergraph.

Description of Method

Fraser and Hipel's (1984) approach to conflict analysis, along with that of Howard (1971, 1989a, 1989b), can be considered in terms of the declaration of a set of states of play which together define the possible outcomes of the conflict, and a rule for determining the progress of the situation between those states. As has been discussed earlier, both Howard and Fraser and Hipel concentrate on the capabilities of individual players to bring about moves among this state of futures in order to identify those states which constitute stable outcomes, or equilibriums.

The essential idea is that of unilateral improvement, or UI. A player is deemed to have the power to move from state i to state j if and only if that player's tactical choice alone changes as the situation moves from state i to state j . In the two existing methods this is relatively easy to discern, since the states of play are themselves determined solely by the combined tactical choices of the players. The existing methods declare a preference ordering for each player over the set of states of play, and if a player prefers state j to state i and has the power to move from state i to state j , he is deemed to have a unilateral improvement from state i to state j .

The Powergraph method also declares a playing space which describes the feasible outcomes of the game and analyses the power and motivation of the participants to move from one state to another. In this overall topological respect it is similar to the existing methods. There are two essential differences, however. First, the playing space of feasible states is not defined directly by the tactical choices of the participants. Instead the possible states of play are determined by direct examination of the conflict situation itself. (A supporting technique to this part of the Powergraph process is shown in Chapter 9). As discussed in Chapter 3, Figures 7 and 8, the use of the tactical choices of the players as the basis for the generation of possible outcomes predisposes towards a set of states which are determined by the prior conceptions of the tactical choices open to the players. The objective of the analysis is to determine what the players should do, i.e. their tactical choices. As such Powergraph derives the tactical choices from the analysis as opposed to assuming what

tactical choices available to the players *ab initio*. Second, movement between states is not determined simply by the powers of one player. In Fraser and Hipel's technique transitions between states which require the cooperation of two or more players are rejected. In the Powergraph approach boolean logic expressions are used to show how the capabilities of more than one player are combined in order to bring about a transition which each desires. Figure 24 below shows the process diagrammatically. The figure shows that after defining the participants in the situation, the possible states of play are defined. These states of play are both the outcomes of the conflict and the (possibly transient) states which, while not being outcomes as such, are definable and important 'rest points' of the system. An example of the latter might be a state of indecision, which might persist for a substantial period of time, but which will eventually be left for an outcome state. For example, the coming together of parties to the negotiating table may be a most significant stage on the development of a conflict, but (notwithstanding North and South Korea) is not usually seen as an end in itself. The phrase 'equilibrium position' is not employed here since the status of each possible outcome, i.e. whether it is transitory or an equilibrium candidate, is a result of the procedure rather than an input. The word 'outcome', then, is to be understood in the sense of a possible outcome which may, in the event, be neither achievable nor desirable from the point of view of the participants.

The next stage in the procedure is to order the players' preferences as to the states. This in turn will be used to determine the extent to which they will wish to use whatever power they have to bring about certain of these states and to avoid others.

The ability of each player to move the system between the states defined above is contained in a matrix called the **transition power matrix**. A logic expression or boolean function is used to describe the various combinations of players' abilities needed to bring about the transition.

The critical part of the process is the application of a simple rule which allows the motivation and power of a player to be compared in order to determine whether that player has the incentive and ability to control a transition. The rule is most simple; in order for a player to

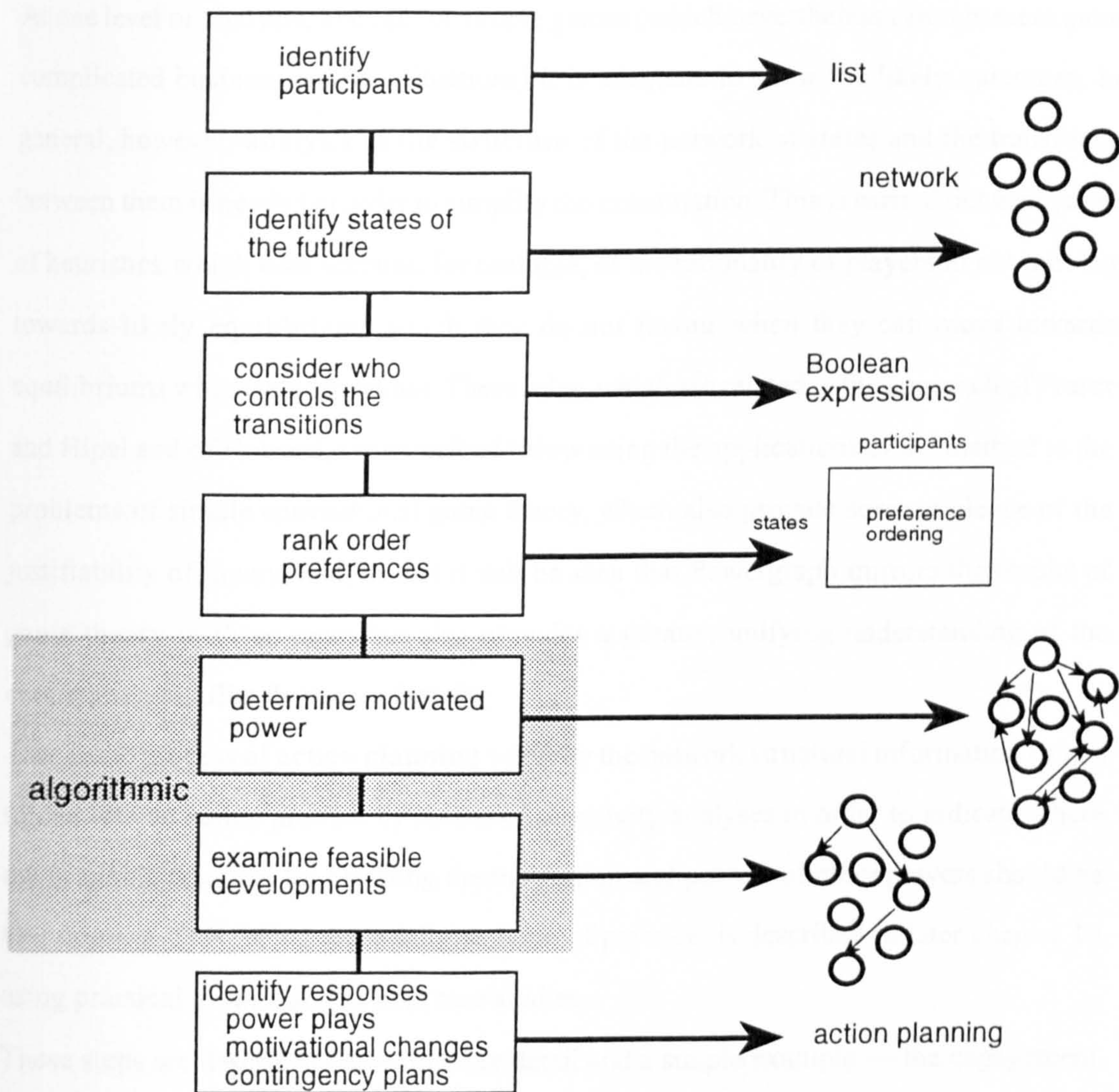


Figure 26: The overall Powergraph procedure

act so as to bring about a change he must have both the ability and the will to do so. This consideration results in the **motivated power matrix** which shows those transitions between states which are within the capability of players and desired by players.

At one level of analysis, enough for simple games (which nevertheless can represent quite complicated business conflict situations) it is adequate to show the likely outcomes. In general, however, **analysis of the structure of the network of states and the transitions between them** is needed in order to simplify the examination. This is carried out using a set of heuristics which take account, for example, of the rationality of players in not moving towards likely equilibriums which they do not favour when they can move towards equilibriums which they do favour. These rules, which are related to the approach of Fraser and Hipel and of Howard, are described below using the applications of the method to the problems of simple conventional game theory, which also provide some evidence of the justifiability of the method, in that it will be seen that Powergraph mirrors the results of game theory in these cases but also provides a greater, unifying understanding of the cooperation/conflict dynamics therein.

Last is the process of **action planning** whereby the network structural information can be turned into an action product by means of sensitivity analyses in order to indicate where the available resource for affecting the motivation and powers of other players should be best applied. This, being essentially an issue of practice, is described in later chapter 10 using practical *ex ante* and *ex post* case studies.

These steps are described below in more detail and a simple example — the engagement of Mardonius, a Persian general, with the Greeks — will be used to illustrate each step of the procedure.

Mardonius and the Greeks - 479 BC

Historical Context

The ambitions of Darius, the Persian pretender to the soil of Greece had foundered on the rocks of Marathon in 491 BC. The Athenian leader at the time was Themistocles, known generally among his contemporaries as Neocles. He was, as Fuller (1954, p26) has it ‘

[m]ore clairvoyant than most of his contemporaries', and he saw that Marathon was more the beginning of a longer war with the rapacious Persia than it was the end of one. Themistocles was fortunate in a number of ways as he commenced his period of sporadic rule over Athens. First, a recent battle between the home city and Aegina had convinced the Athenians of the need for a strong navy, a position which was to prove critical in the outcome of the Battle of Salamis, not treated here, which provided the context for the subsequent land engagements. Second, a rich vein of silver had been found at Matonieia, and Themistocles was able to persuade the polis of the merit of using it, not - as had been proposed - as a windfall gift of bullion to the citizens, but to build a force of one hundred triremes. Third, Darius' motivation was temporarily weakened by a diversionary revolt in Egypt. Last, before Darius could focus his attention on the Greek homeland, he died, to be succeeded by his son Xerxes, who had to end the Egyptian revolt and then spend time establishing himself on the throne of Persia.

By 484 BC, however, Xerxes had secured his position and was ready to invade Hellas. As Herodotus (Rawlinson, 1880, VII p143) writes, '*... was there not a nation in all Asia which Xerxes did not bring against Greece*'. The invasion army was a formidable one. The Hellespont was bridged in 482, and by 481 Xerxes was in a position to send emissaries to Athens and Sparta to demand the traditional supplicant gifts of earth and water. He began his advance into the Greek homeland and, in particular towards Therma.

The Greeks, however, were collectively already well aware of the Persian threat, to the extent that a pan-Hellenic congress had met at Corinth, under the presidency of Sparta, at which the defence of the peninsula was discussed. The Peloponnese was understood to be the wellhead of Greek independence, and, thereby, the defence of the Corinth isthmus was vital. It was also understood, however that if the defence were to be concentrated exclusively on the isthmus, the northern flank of the Greeks could be turned, and the Corinth region lost by that means rather than by direct attack. It was also necessary, then, to hold the enemy in the north.

Xerxes engineered an agreement with the Carthaginians that they should mount attacks on

the Greeks of Italy and Sicily, while the Persians took the attack of the Greek mainland. Their implementation of their own element of the plan was to have a meeting of the sea force and of the land force in the vicinity of Thermopylae. Simultaneously the supporting force of Carthaginians would block the entrance of the strategically important Euboean channel, thus bottling up the Greek fleet.

The Persian movement of 400 warships to the area was disastrous; caught at sea in a savage gale, many were lost. The next day, however the remainder regrouped and, as they were preparing their attack on the remaining Greek ships, numbering 53, a ship arrived from Thermopylae which brought the fell news that the all-important pass leading to Athens had been forced by the Persians, and the road to Athens lay open before them. The Greeks had no option but to withdraw their fleet to the south towards Salamis. Now only the tiny Greek flotilla stood between Athens and disaster.

The Battle of Salamis is well recorded by many authorities (Fuller op. cit pp 38-43). To cut a long and courageous story to the bone, the Greeks drove off the Persian fleet without subsequently pursuing and destroying it. Nevertheless the Persian fleet, unchallenged in any serious way until that time, was left with its supremacy in tatters. Worried over his lines of retreat back to Persia over the Hellespont, Xerxes sent his fleet back towards Asia, and followed a few days later with a withdrawal of his army to the north, away from Athens which they had already invested.

Xerxes soon recovered his nerve after realising that the Greek navy had not moved to destroy the Hellespont bridges (since they would have thereby left the Persian stranded on the wrong side from their homes and would have caused the destruction of the Greek economy by foraging). Mardonius was left with 300,000 of the best Persian troops (according to Herodotus). Without a fleet, however he could not renew his attack on the isthmus *per se*, and so chose to save the glory of the Persian empire from ignominious withdrawal by a diplomatic ploy, based upon the unending debate within and between the Greek city states.

Conflict situation

Fuller (op. cit. pp43-44) sums up the situation succinctly,

'In the early summer of 479 BC he [Mardonius] sent Alexander of Macedonia to the Athenians with an offer of a free pardon for the past and an alliance with Persia on equal terms. This became known to the Spartans who at once took alarm, and the Athenians agreed to reject the offer on the understanding that the Spartans would join then in an offensive against the common enemy. 'Mardonius then began stirring up trouble within the Peloponnese. Knowing that the Argives were hostile to the Spartans, he intrigued with them to attack the latter so that when the two were engaged he might suddenly march down from the north and carry the isthmus by a coup de main. The plot miscarried. 'Mardonius then returned to a modified edition of his first plan. This time it was to bring the Spartans into the open by putting pressure on the Athenians. On his way down from Thessaly, he changed his direction accordingly and marched on Athens, at the same time sending an envoy to Salamis to reopen negotiations with the Athenians in the hope of alarming the Spartans. It succeeded in doing so; Aristides at once sent representatives to Sparta urging immediate action should the Spartans wish to retain the loyalty of the Athenians. The result of the threat was that after considerable delay a field army of 5000 Spartan hoplites and 35000 armed helots was sent to the isthmus under the command of Pausanias, regent for Pleistarchus, the young Spartan king. Mardonius, who had thus far refrained from damaging Athens, then fired the city and withdrew to Boeotia to draw the Spartans and their allies into country more suitable for his cavalry to operate in.'

Fuller's essential analysis (op. cit. p43), then, is that Mardonius misjudged the preference order of the Spartans, assuming erroneously that they would prefer *' a reconciliation with the Persians to an alliance with Sparta.'*

Identification of participants

It is first necessary to identify the participants in the conflict. The key question here concerns the criteria for inclusion. Firstly, one observes that to qualify as a separate participant, an entity must have differences from other participants in terms of any of the following:

belief space

preference ordering

objectives

tactical choices

freedom of action.

Second, elements of an organisation (SBU's or individuals on the board, for example) should only be included when they have an exercisable and distinctly different motivation. As an example, it is possible to treat the individual board members of a company as different players, since one might argue that each of them separately has different means of influencing the situation on behalf of their company, but this would be unnecessarily complicated since the totality of their freedom of action is comprehended by the common motivation of the set of board members who act to achieve the aims of the company as a whole. Only if the objective of the board members are different from those of the board should they be included separately.

It is observed that while an expansion in the number of outcome states (discussed below) results in a combinatorial expansion of the work content, an expansion of the number of participants is only a linear expansion, since for a given number of states the number of participants determines the number of examinations of each transition for the influence and power being exerted therein.

Lastly, it should be noted that successive passes through the Powergraph approach for a given problem may well show up differences between the motivations of entities initially agglomerated. If this is observed, the differently motivated entities are then split from the 'parent' participant for the next iteration.

In the illustrative example we see that an appropriate set of players is

<i>P</i>	The Persians (Mardonius)
<i>A</i>	Athens
<i>S</i>	Sparta

State Definition

The second step in the process of modelling the conflict is to identify the states which the situation may resolve to, or which may act as temporary but significant intermediate states. A particular technique (top-down value-based state generation) for generating states for Powergraph is described in Chapter 8, but the following observations are relevant here.

Feasibility of outcome

The existing conflict resolution methods place much emphasis on the feasibility of states, representing in the model only those outcomes (defined by the choice of tactics among the participants) which are reachable by the set of tactics defined *ab initio*. This is not the method of Powergraph. We should not concern ourselves with the feasibility of outcomes as input data; rather, the outcomes will emerge as feasible, transitory, etcetera, from the analysis. Frequently the subject of such observations as 'If only we could achieve ...' is a useful source of desired outcomes.

Examination of attributes

The general approach of EFAR, in selecting a number of factors with which to characterise the future states, offers potential for cuing those states which the client company may find desirable, or indeed undesirable. An example of this can be found in the present example, where the various motivations of the Athenians, Spartans and Persians are used to cue the appropriate state definitions. The process is one of characterising the attributes of a situation which would be significant to the particular player. Other players may see other attributes as significant. For example, in the *The Spanish Mayor* case reported below, three policemen have been arrested having tapes of telephone

conversations in their possession (which constitute the threat to the mayor). These three will clearly view the disclosure of the information as important and material, but they will be equally concerned as to the maintenance of the information in their own possession, since public disclosure will prevent the use of the tapes as part of a plea bargain.

Tactical choices

As part of the outcome identification the tactical choices of the players are relevant. It would be inappropriate to define the outcomes exclusively as points in a space defined by the tactical options of the players, for reasons discussed above, but the *a priori* freedom of action of the participants does allow cues to further definition. Often the outcome states can be partly defined in terms of the tactical choices of the participants with the addition of other state variables.

Extension processes

Identification of some outcomes allows the extension to others. A diagram of outcomes can therefore be grown by considering what outcomes could result from an particular state. An example of this is the Powergraph treatment of the classic game, *Chicken*, reported below, in which Powergraph states are extended from the standard list of states defined in the game theory literature.

Recursion processes

The Powergraph approach allows the redefinition of outcomes in the light of a first pass through the analysis. Other outcomes can become apparent in the processes of analysis or of interpretation. Both *The Spanish Mayor* case and the *ex ante* case of Oxford Scientific Films Ltd. of Chapter 10 exhibit this recursion.

Here we have the following states:-

- 1 Athens and Sparta allied but neutral towards Persia. No offer from Mardonius.
- 2 Athens and Sparta are allied but neutral towards Persia who is offering an alliance to Athens.

- 3 Athens has accepted the Persian offer, thereby allying with P.
- 4 Athens and Sparta are allied and at war with Persia
- 5 Athens and Sparta are unallied and are both neutral to P
- 6 Athens and Persians are at war. Sparta is neutral
- 7 Sparta and Persia are at war. Athens is neutral.

Preference Ordering

A table is drawn up showing the preference which each participant has for the defined outcome states.

Table 15 shows the relative preferences between the various states for the three participants in the illustrative example. Each entry shows the ordinal preference of that state. Thus 3 means that the state is third most favoured. State numbers are shown thus, 10.

	A	S	P
1	1	2	3
2	4	3	2
3	3	7	1
4	2	1	7
5	5	4	4
6	7	5	6
7	6	6	5

Table 15: Preference ordering for Athens, Sparta and Persia

We see here that while Athens would prefer a state (1) of peace (or at least of nonaggression) she is quite prepared to go to war with Persia, but only if Sparta is with her (4). If that is not the case, then Athens would accept the Persians generous offer of an alliance (3). Failing that Athens would prefer the security of an alliance with Sparta (5 to 7) to the prospect of facing the world without a friend. Lastly, Athens would be rather chary about either herself or Sparta facing the Persians in war alone (2). Almost certainly the Greek combatant would lose, and the other would follow.

Sparta is quite happy with the *status quo* (2), but would prefer a combative alliance with Athens (4). Generally speaking it is better from her point of view to confront the enemy than it is to wait to be overrun. Sparta is less keen on the idea of a threatening Persia

seducing her ally (2) and thoroughly dislikes the idea of Athens and Persia joining forces (as they eventually would) against Sparta (3)

The Persians prefer that Athens be broken away in order that the difficult Peloponnesian situation can be defused and so that Sparta can be isolated. Persia thoroughly dislikes the prospect of taking another tactical beating by the combined forces of Athens and Sparta (4) and is not keen on any war with a Greek participant if the other is merely neutral and therefore likely to join the war at any time.

Chapter 9 shows a method of relating these preference orderings to the different agendas of the players, in order potentially to link the strategic games (which operate at a higher level than the Powergraph technique) of the different participants.

Examination of Transition Power

A matrix is then drawn up which eventually defines the extent to which each of the players has control over the transitions between each pair of the possible outcome states. This stage incorporates a large amount of subjective and often wide ranging information elicited from the knowledge base of the domain experts, and requires careful annotation as to the basis of the conclusions arrived at. Each transition should have a brief pen picture describing the nature of the influence being exerted by relevant participants in that transition. The leading diagonals of the transition matrix represent the 'sustainment power' at each location. This is the ability of participants to resist movement from the state in question as opposed to their ability to move away from it. Usually the sustainment power can be inferred from the ability of the players to move from the state, but it can also occur that the ability of players to prevent transition is different from their ability to move.

The influences of a number of participants are expressed as a boolean expression.

Table 16 below shows the degree of influence held by the Persians and the Greeks over the transitions in the present example.

	1	2	3	4	5	6	7
1	A.S.P	P	\	A.S	A+S	A	S
2	P	A.S.P	A	A.S	A.S	\	\
3	A	A.S	A	A.S	A	A	A.S
4	A.S	(A+S).P	A.S	A.S	A.S	S	A
5	A.S.P	A.S.P	A.P	A.S	A.S	A	S
6	\	A.S.P	A.P	S	A	A.S	\
7	\	\	A	A	S	\	A.S

Table 16: Transition power matrix for Mardonius and the Greeks

In the table we can see that Persia has control alone over transition 1>2. The sustainment power at state 1 is in the hands of A S and P, the first two because they could choose to move away by declaring war on the Persians or by breaking their alliance, and P because of her power to make the offer of an alliance to Athens. Other critical transitions are 4>2, where A or S could stop the Greek alliance warring with the Persians, but the Persians have control over the offering of an alliance to the Athenians. Both conditions (A OR S) and (P) are necessary, making up the boolean expression (A OR S) AND P, written (A+S).P. The transition from 4>1 is critical; Athens and Sparta must agree to end the war in order to reach state 1 from state 4, otherwise they will reach state 5 or 6.

At this stage it is often convenient to represent the network of outcomes, preference ordering and transition powers in a graphical form. This is not essential, however, and it is often the case with more complicated situations that the matrix representation remains the more convenient. In addition the matrix form remains the easier input format for computerised reduction.

Relaxation of Matrix

The next stage in the process is to examine the implications of the preference ordering upon the willingness and motivation of the participants to exert the power represented in the model. If it is not in a party's interest to move from one state to another, he will not do so, even though the transition is in his control. Such a preference sanctioning will result in the participant's influence over the transition disappearing from the model. This is the

exact analogue of the unilateral improvement (UI) criterion adopted by both Fraser and Hipel (1984) and by Howard (1971).

Often the rationality of such processes is easy to see and the relaxation of the diagram is straightforward, but in other cases issues of myopic versus non-myopic motivation arise which require different methods to be applied. These more procedural approaches are discussed, using the Battle for Trafalgar Case, below. Many strategic situations can be ‘solved’ by the inspection method.

In the illustrative example, applying the preference ordering to Table 16 gives Table 17, the motivated power matrix, where the power of a participant to induce transition is modified by checking that a motivation, expressed by an improvement in the preference, exists. If a participant has the power to make a move, but the preference of the terminal state is less than that of the source state (i.e. the result is less preferred, so that the preference order number is greater), no motivation will exist to bring about the transition.

	1	2	3	4	5	6	7
1	\	P	\	\	\	\	\
2	\	\	A	A.S	\	\	\
3	\	\	\	A.S	\	\	\
4	\	\	\	\	\	\	\
5	\	A.S.P	A.P	A.S	A.S	\	\
6	\	A.S.P	A.P	S	A	\	\
7	\	\	A	A	S	\	\

Table 17: Motivated power matrix for Mardonius and the Greeks

Generation of graphical presentation

It is almost always desirable at this stage to represent the control over the transitions as a diagram such as Figure 27, where arrows indicate feasibility of a transition, and the boolean expressions attached show the influence exerted by the different participants. Only in the case where the diagram contains too many states and transitions for it to be comprehensible is it appropriate to work with the exactly equivalent (motivated power) transition matrix. Additionally, the diagram itself provides means of communicating the essential structural

issues to respondents, as will be seen in Chapter 10.

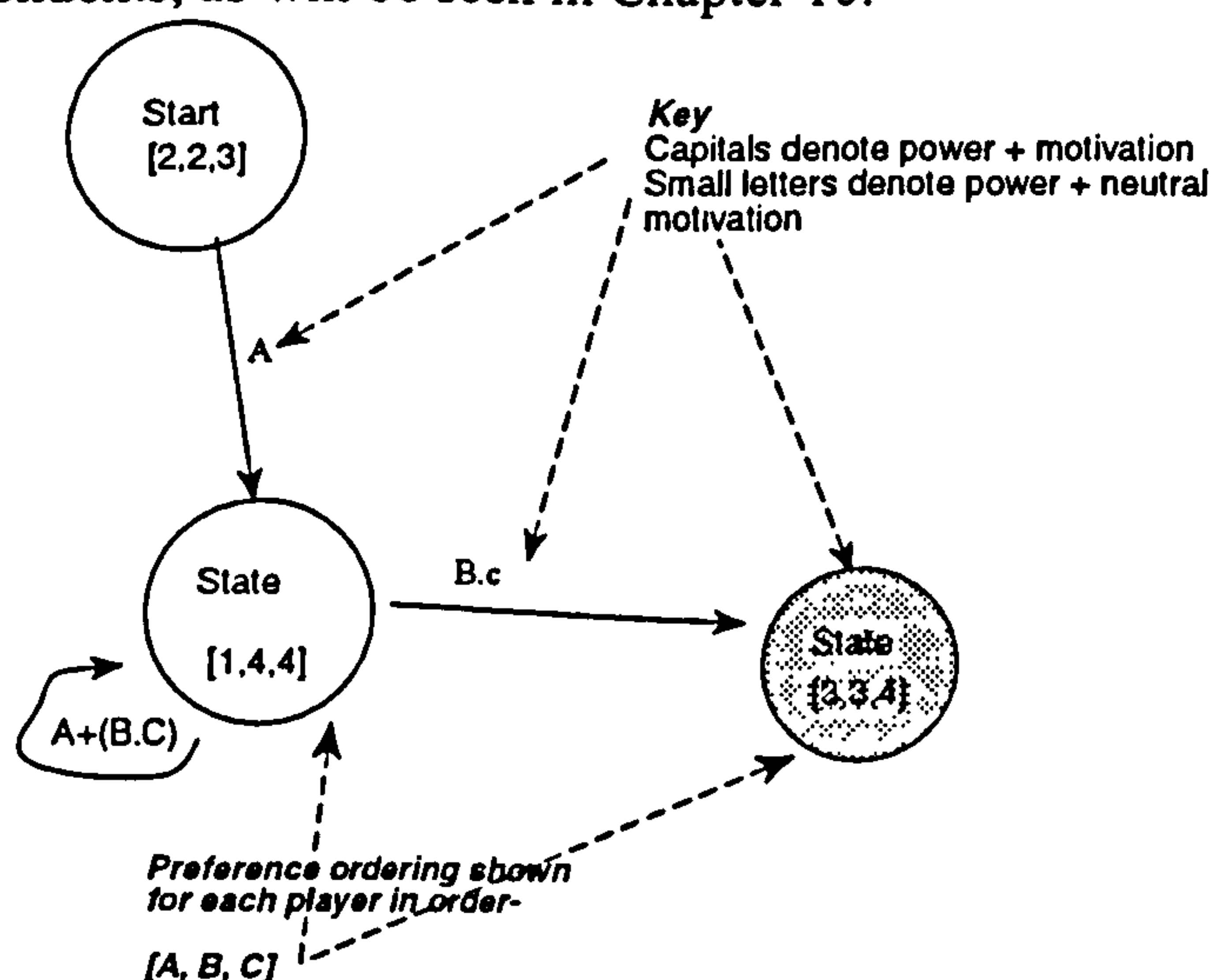


Figure 27: Part of a hypothetical Powergraph directed graph

Where necessary, preference ordering is shown as a 'word' attached to each state, as, for example, (at state **Start**), [2,2,3] where the preference ordering of the participants is shown in numerical or alphabetical order. Here A ascribes preference ordering 2 to the state, (meaning that there is one other state which A likes better) as does player B, whereas C ascribes third preference to the state.

Arrows imply the feasibility of a transition from a source state (at the foot of the arrow) to a sink or terminal state at the head. Attached to the arrow is an expression such as (A.B+C) giving the logical expression which indicates which player or combinations of players have control over the transition. In this example (A.B + C) indicates that A and B together can bring about the move or C alone can do so. Where a player has the power to bring about a transition but is not motivated to do so because the preference ordering of the sink state is the same as that of the source state (i.e. the motivation is neutral), a small letter is used as, for example, on the transition from **State** 1 to **State** 2 in Figure 27. Conventionally, states are written in bold, thus, **State** 1 and transitions are written thus, **Start** > **State**. Where necessary, Φ implies that no one has control over the transition. It could be random or predetermined, or under the control of a participant undefined in the model.

For the illustrative example, the matrix of table 17 can be represented conveniently as a

directed graph or state transition diagram This is shown in Figure 28.

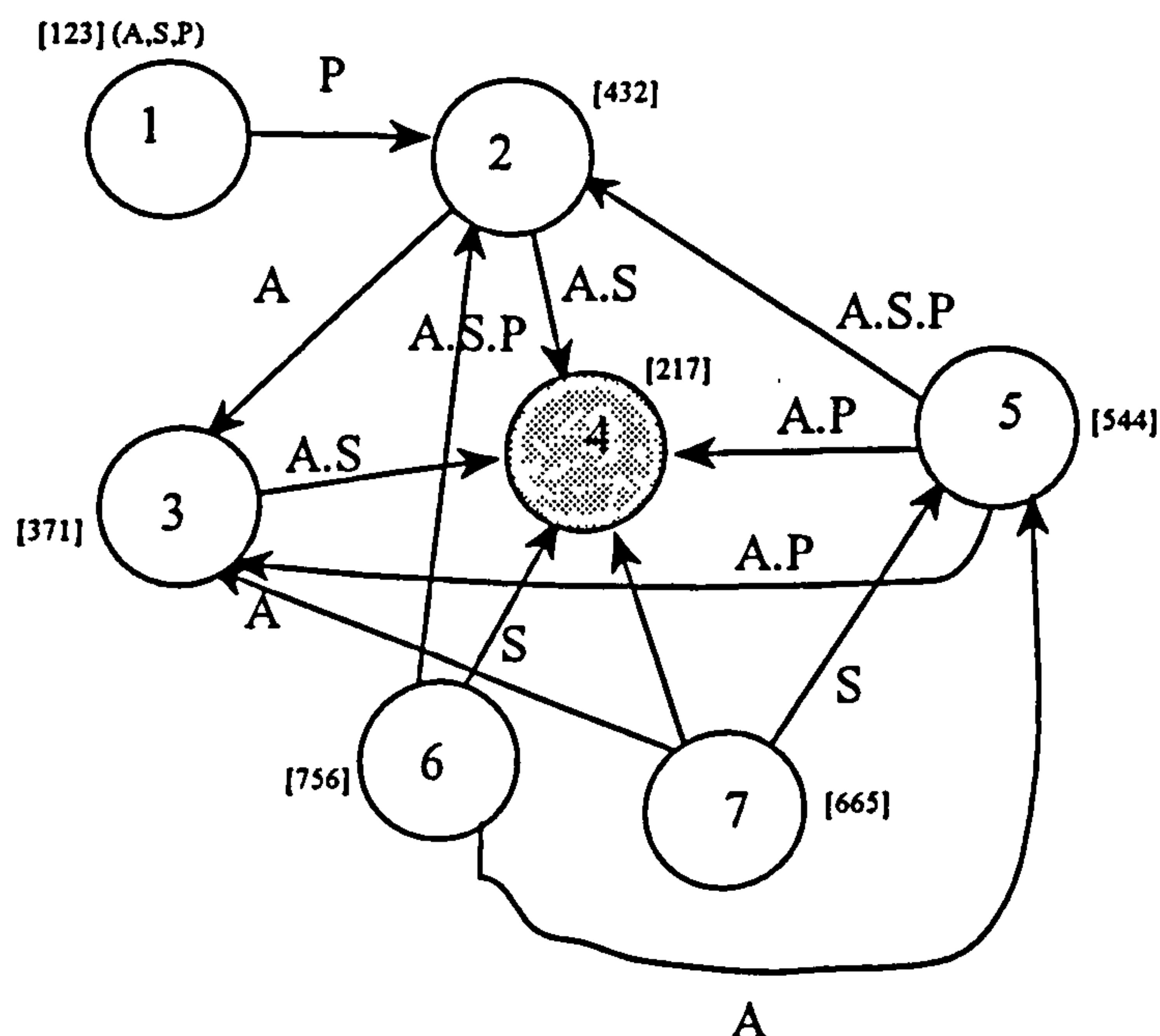


Figure 28: Full directed graph for Mardonius and the Greeks

Stability Analysis

At this stage in the Powergraph procedure the transition diagram (or equivalently the motivated power matrix, since they are topologically identical) is examined for equilibriums. Certain rules exist for the simplification of these diagrams, and these are covered in more detail below, but often the examination of the diagram is essentially intuitive, and certainly for simple diagrams, the stability analysis is straightforward.

In the case of Mardonius and the Greeks, as one would expect from the simplicity of the diagram, the analysis of Figure 28 is indeed straightforward. First, it should be observed that state 4 has only arrows going into it, with the effect that it represents an end state or equilibrium state, in the sense that under the assumptions made in the model regarding the power and motivation of the participants, state 4 is one of the states to which the situation will progress.

Second, certain states (6 and 7) possess only outgoing arrows. Thus, unless the state of affairs is forced into one of those states the model cannot reach them. They thus represent

unreachable states which can be deleted from the stability analysis at this stage. Having carried out these deletions we observe that state 5 then has only outgoing arrows, so that it, too, can be deleted. This leaves the diagram of Figure 29, which shows the fundamental stability of the states in the model.

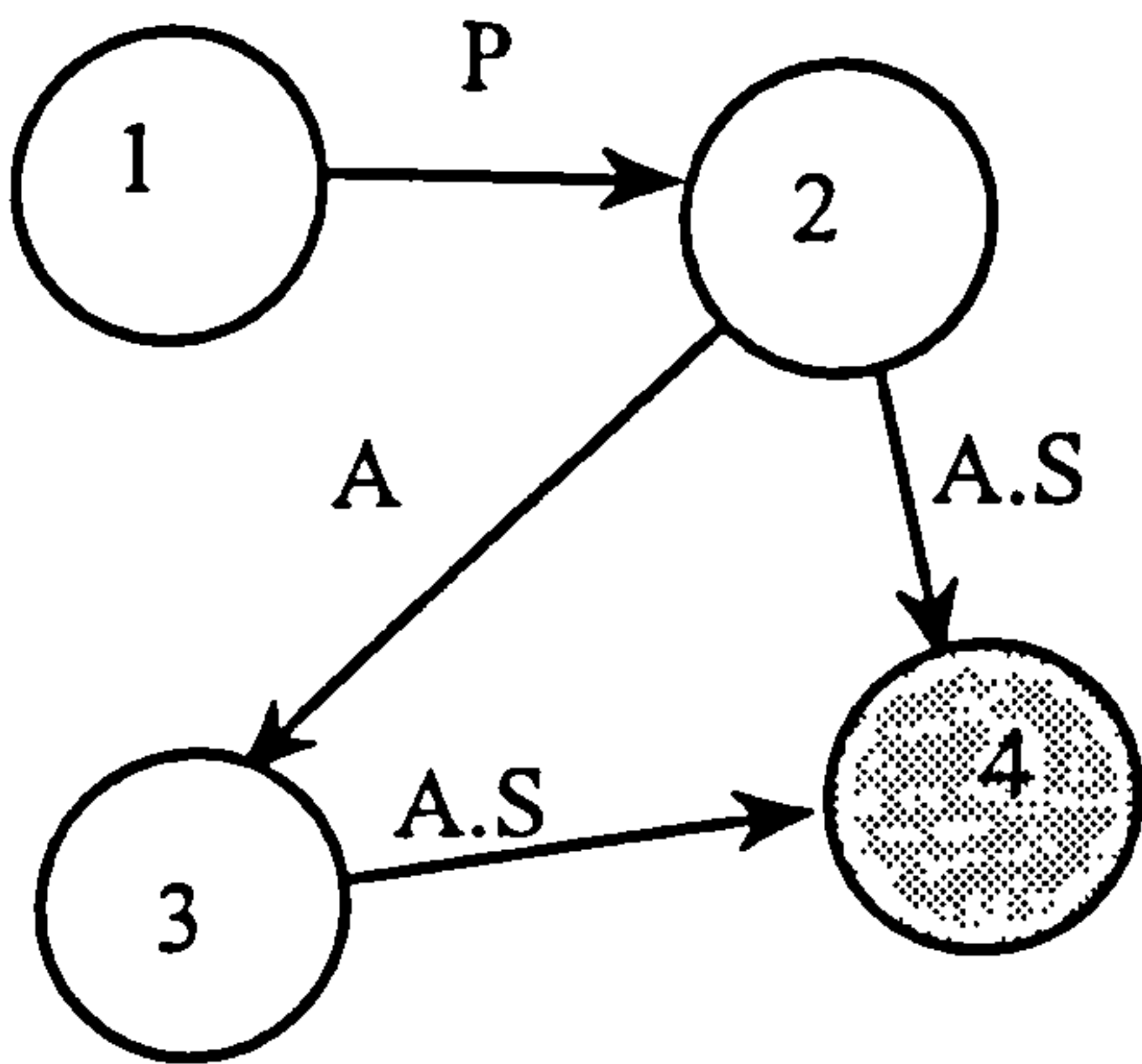


Figure 29: Reduced transition diagram after deletion of unreachable states

We see in figure 29 that under the control of the Persians, the system is moved to state 2, which represents the Persians offer to the Athenians. From this offer the system can move, under the control of the Athenians alone or the Athenians and Spartans acting in concert, to states 3 and 4 respectively. The transition 1>3 represents the acceptance of the Persians' offer by the Athenians. Equally, the Athenians and the Spartans could agree at this stage (state 2) that they will go to war together with against the Persians. This would require certain information to be made available. First, the Spartans need to become aware that the system is at state 2 rather than at state 1. They find this out by their spies in the Athenians' camp, but they could equally well have found out that the offer was on the table by an act of the Athenians themselves, or indeed by a leak from the Persians' camp. Note that it is not in the Persians' interest to release the information, since by keeping it secret they can deny the communication necessary to allow the function A.S to operate. In other words, without the information as to which state the system is in, the Athenians and the Spartans could not agree to act together in order to achieve state 4.

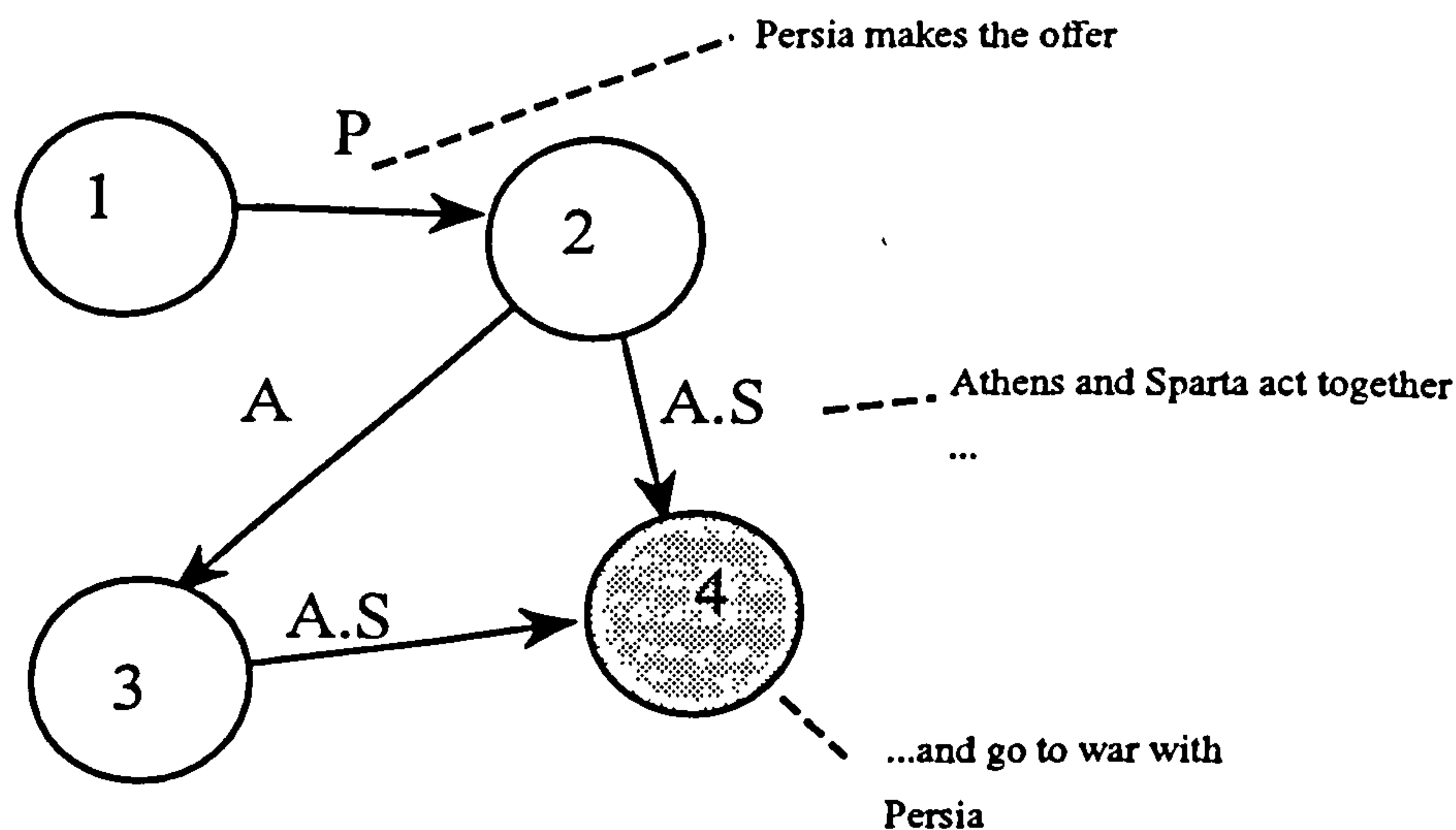


Figure 30: Summary of stability analysis for Mardonius and the Greeks

Another route to state 4 is *via* state 3. Observe that both the Athenians and the Spartans prefer the state of joint warfare against the Persians to the alliance of the Athenians with the Persians. The Athenians reject the hegemony of the Persians, suspecting that the great Persian economic machine will allow them the power subsequently to renege on the agreement offered by Mardonius; the Spartans, on the other hand, feel strongly that such an Athenian/Persian alliance spells catastrophe for their warlike but ultimately vulnerable state. Thus both sides, (A and S), are motivated to enable transition $3 \rightarrow 4$ to take place. We thus see that Fuller (op. cit. p 43), in offering the observation that ‘...[the Athenians’] *past suggested that they would prefer a reconciliation with the Persians to an alliance with Sparta*’ focuses on the fundamental structural issue in this system. If the Athenians had preferred the temporary stability of an alliance with the Persians to the cauterisation of a joint front against them, the model would have ended up at state 3, and the link between $3 \rightarrow 4$ would not have taken place because of a lack of motivation on the Athenians side to go to war.

The model shows us more than Fuller’s analysis, however. Mardonius tries, in Fuller’s words (ibid.) ‘...to bring the Spartans into the open by bringing pressure to bear on the Athenians’. In other words Mardonius attempts to force the system into state 6, where the

Athenians and the Persians are at war. ' [Athens] at once sent representatives to Sparta urging immediate action.' The Spartans follow transition 6>4 by sending 5000 hoplites to the Athenians' assistance. The Persians now faced a formidable motivated Greek army on the Corinth isthmus. Mardonius had failed in his attempt to split the Greek forces. Ultimately this led to the decisive battle of Plataea, where Mardonius, fatally, so compressed his forces that his archers, which, might have held the key to success, were unable to generate the rate of fire necessary to drive back the combined Greek forces. The Persian threat to Hellas was never again to be as great.

Recursion

Although it is not strongly in evidence in the illustrative case study used here, in practice, Powergraph shows itself to be most powerful when used in an iterative fashion. Because of its usefulness in making sense of the complex management environment in which strategy is identified and implemented, one Powergraph cycle provides an improved understanding which alters the perceptions of the user of the elements of the model. See Figure 31.

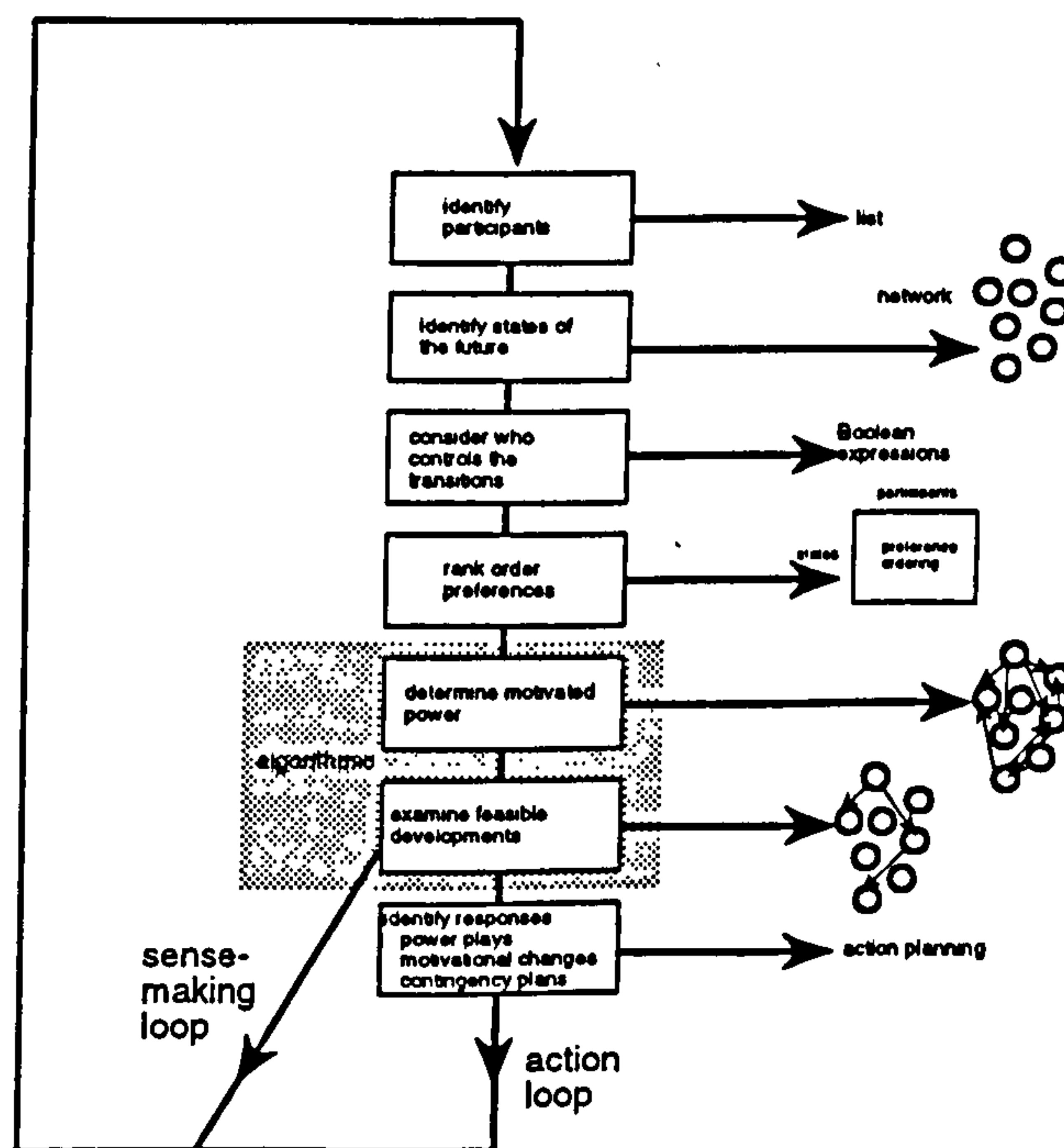


Figure 31: Action planning and sensemaking in the Powergraph procedure

For example, new players may be identified as a result of analysis of the powers and influences in the transitions. Equally, new states may emerge from an understanding of what is possible for the opposition or indeed ourselves to do. Lastly, the whole basis of attention of the analysis may change. This last effect is shown effectively in *The Spanish Mayor* case study, described in Chapter 9. Here we see a first phase of analysis where the attention of the analyst is upon the gross characteristics of the problem; who is a real threat, who is a potential target for influence. This leads to an improved understanding of the threat to the mayor to the extent that certain parties (in fact, the Chief of Local Police) who were thought to present a serious threat to the political wellbeing of the mayor are, in fact, unmotivated to use any power that they have. This understanding then leads to two activities. First, it gives a targeting structure on which basis new information is gathered. 'Does the arrested policeman actually have the threatening tapes?' 'Does the local judge already know the situation?' This new information then forms a basis for another stage of analysis. Second, it provides a basis for a new path of analysis of itself. Concentration in this second phase is upon the effect of each of the parties releasing the information which it is supposed they have.

The second phase does not represent a subset or a resolved picture of the first phase. The two analyses are connected but separate. In a sense the second analysis is simply a picture of the same complex problem using a different sensor, more focused onto a particular aspect of the problem.

There is a second respect in which the iterative approach is necessary, and this is shown in Figure 31 by a different path, marked 'action loop'. This iterative path recognises the intervention effect, whereby action taken as a result of analysis affects the situation being assessed. This action may be a direct intervention, or a gathering of information. In an extreme case it may be the knowledge that the situation is being addressed. It has been observed, for example, that in the suffocating atmosphere of the defence construction oligopoly, knowing that a company is developing a strategy alters the industry for which that strategy is being developed, even before any action is taken.

Case Study — The Battle for Trafalgar

In order to show in more detail some of the characteristics of the various elements of the procedure of Figure 26 a case study, *The Battle for Trafalgar*, will now be described.

The situation derives from the struggle between BAe and GEC for two major naval projects, the replacement NATO frigate, (known at the time as CNGF) and the replacement UK nuclear attack submarine, the Batch Two Trafalgar Class or B2TC. The case study is presented as an *ex post* description of a rich and strategic level conflict which is not atypical of the struggles between large defence companies for new markets. Because it is *ex post* it is not an appropriate metric for the ability of Powergraph to predict the evolution of a conflict situation, but, equally, because it is *ex post* it provides an opportunity to weigh the effectiveness of Powergraph in representing a complicated and well-understood struggle. An analysis of this situation using the methods of Fraser and Hipel appears below by way of comparison.

The Battle for Trafalgar

Background

This example of the application of Powergraph to a strategic business conflict/cooperation situation concerns a real decision sequence made by a major defence company, British Aerospace PLC, when deciding what positions to adopt in teaming on two related projects. The sequence of events took place during early 1993.

Firstly, a word is necessary about the contracting environment of the time. In accordance with a general desire to tighten up the effectiveness of defence procurement in the aftermath of series of unsatisfactory procurements such as the Type 2400 (Upholder) class submarine (HCDC, 1991), the AEW Nimrod and the Foxhunter radar, the Chief of Defence Procurement, Peter (now Sir Peter) Levene had instigated with strong cabinet support a policy of tangible and substantial risk transfer to industry coupled with a requirement to produce a single contracting point and a policy of value for money as measured by cost/operational effectiveness analysis. Within the naval procurement organisation this resulted in a stated desire that the next surface and submarine procurements would be competitive.

There are two projects in question, the first being the provision of a number of submarines to enhance the existing fleet nuclear submarine flotilla, and known as the Batch 2 Trafalgar Class (B2TC). This project is dominated by two players, VSEL, the existing builders of the Trafalgar class submarines on which the new design is firmly based, and GEC who have a strong interest in the provision of weapon systems for B2TC and in developing themselves into a position of being a prime contractor for the project as a whole. The motivation of VSEL is to maintain a dominant position in the project, to the extent of claiming a prime contractorship position for the submarine. VSEL are threatened in no small way by the ambitions of both GEC and BAe to grow their prime contractorship capability and experience (gained respectively in home and overseas surface ship building and in aircraft and overseas defence systems provision). While VSEL at the time had an impressive track record of producing excellent submarine hulls which, in service performed as well as any in the world, there was a perception that their ability to contain and manage the high risk elements of a whole submarine procurement was unproven. A common perception at the time was that the addition of either GEC or BAe to their team would fill that credibility gap and provide a 'dream team'. It is also worthy of note that it was an imperative of VSEL at the time that they should remain in command of the project. There was little attraction to them of retaining work in their yard at Barrow-in-Furness while losing managerial control of the project.

The second project under consideration was a similar procurement of a new NATO frigate known at the time as the common new generation frigate or CNGF. Here the predominance of the players is reversed in that GEC hold the advantage because of the experience of their Yarrow Shipbuilders' yard on the Clyde in building appropriately sized frigates. VSEL is viewed as being competent but inexperienced at this type of build. The advantages to VSEL of having BAe join their frigate team are large, in VSEL's view, since the provision of effective surface ship weapon systems has been a BAe competence for some years. BAe also brings with it a competence in risk management which VSEL felt at the time would be important in fighting off the threat from GEC. From GEC's point of view BAe are useful

because of their weapon system competence, but in addition having BAe in their camp would deny VSEL an important competence to the extent that their bid would be unlikely to be credible.

The problem

BAe has been chasing these projects for some years. Because of a concatenation of circumstances, a simultaneous decision has to be made regarding the team which BAe will offer to join, whereas previous planning had assumed that these teaming decisions would be made sequentially.

At heart the problem is this: should BAe offer to join with one partner (GEC or VSEL) on both projects or should it 'split the pair' by offering to do each project with the company that is more likely to win? The commercial directorate of BAe at the time was of the opinion that since VSEL was almost certain to win the submarine contract it made no sense to join with GEC on the submarine contract; moreover, since GEC was more likely to win the frigate contract it made no sense to join with VSEL on the frigate contract. Hence the 'split the pair' option was recommended and, in fact won the day, as will be seen, with interesting consequences. The counter-argument to 'split the pair' is that since workshare won in a negotiation tends to be proportional to the marginal benefit brought to the team, it makes more sense to partner with one company for both projects, since in that circumstance the chosen company would have the expected workshare on their likely project to give away (conditional on eventually winning, admittedly) and would view the benefit of having BAe join its team on the other (less likely) project as being great. This argument then supports a position diametrically opposed to 'split the pair', advocating a commitment to a single prime, be it VSEL or GEC.

Structural issues

It should be noted that apart from the failure of BAe to analyse fully the situation, there is no belief space problem here. Each of the protagonists have spent most of the previous four years in constant discussion over the two projects, and their view of one another's

objectives can be said to be complete through the medium of public utterances and through semi-public conversations between senior executives of all companies. Moreover joint teams have been in existence for a number of years engaged in primary design for the two different projects, which have lent important insights into the likely approaches of opposing teams.

The players

The participants in this strategic struggle, then, are as follows

- B* = BAe's System and Services Division
- G* = GEC Naval Systems, representing the interests of its weapon systems division, Marconi Underwater Systems Limited (MUSL) and Yarrow Shipbuilders Limited (YSL)
- V* = Vickers Ship Engineering Limited (VSEL)

The states

Start	BAe is teamed with no one and GEC and VSEL are separately forging teams to bid for the two projects
Split	BAe offers to team with GEC on the frigate and VSEL on the submarine
GEC alliance	BAe offers to join the GEC teams on both projects
VSEL alliance	BAe offers to join the VSEL teams on both projects
frigate only	BAe joins with GEC on the frigate alone
s/m only	BAe joins with VSEL on the submarine only
freeze out	BAe has no position on either project

Other states where, for example, BAe teams with VSEL on the frigate alone were rejected out of hand by the BAe board very early in the actual analysis and do not appear here.

Rank ordering of preferences

Table 18 shows the preferences allocated to the three companies in respect of the states defined above. It can be seen that, from BAe's perspective, being frozen out is the worst

state, and that they would prefer the split position of all, with a preference for an alliance with GEC over VSEL (for peripheral strategic and long term reasons) over an alliance with VSEL.

From VSEL’s point of view, the alliance with BAe is a good option, since it will increase the chance of winning surface ship work for their Barrow-in-Furness yard, and they see that because of BAe’s declared development path in to submarine prime contractorship, BAe will be willing to accept a relatively small workshare in order to obtain a foothold. VSEL in turn, protecting their strategic development path of retaining an effective monopoly position in submarine manufacture in UK, while expanding their surface ship throughput (HCDC, 1990, 1991). VSEL, therefore, would prefer most states over that where BAe is assisting their competitor on the frigate, GEC. What they will not accept is the ‘cuckoo in the nest’ whereby BAe take work (from what VSEL sees as their already secure submarine position) while assisting GEC.

Preference Ordering for Trafalgar I			
	BAe	VSEL	GEC
start	7	7	7
split	1	6	6
s/m only	5	5	4
frigate only	3	3	1
VSEL alliance	4	1	5
GEC alliance	2	4	2
freeze out	7	2	3

Table 18: Preference ordering for Battle for Trafalgar case

From GEC’s point of view, it would like to see BAe on its side in the submarine competition in order to remove it from VSEL’s team. Similarly GEC has a preference for BAe to assist it in the frigate bid. GEC would be quite happy to see BAe frozen out (i.e. not obtaining a position on either project because with BAe out of the game GEC would feel fairly confident in the long term of obtaining control over the naval prime contractorship opportunities on

both submarines and surface ships. VSEL view the expressed intent of BAe to enter the naval prime contractorship business as a line of weakness over which it can be threatened, the main force of argument being that major opportunities in this sector come along very rarely, and the ability of a company to win any particular project is strongly conditioned by its performance in previous projects of that type together with the knowledge and skill won in previous implementations (Sandler and Hartley, 1995, pp147, 148).

Influence matrix

Transition Matrix for Trafalgar exercise							
	start	split	s/m only	frigate only	VSEL alliance	GEC alliance	freeze out
start	B	B	B	B	B	B	\
split	\	B.V.G	B+G	B+V	B.V.G	B.V.G	V.G
s/m only	\	V.G	B.V.G	\	V	\	B+V
frigate only	\	V.G	\	B.V.G	B.V	B.G	B+G
VSEL alliance	\	V.G	B.V	B.V.G	B.V	B.V.G	B+V
GEC alliance	\	V.G	B.V.G	B.G	B.V.G	B.G	B+G
freeze out	\	B.V.G	B.V	B.G	B.V	B.G	V.G

Table 19 :Transition matrix for Battle for Trafalgar. In the table \ indicates an infeasible transition

Table 19 shows the influences being brought to bear on the transitions between the states defined above. It can be seen that many transitions are not deemed feasible, for example, moving directly from the start to being frozen out is not a sensible transition. Others are under the control of participants who have a unilateral sanction on its persistence. For example, from the split state either GEC can reject its element of the proposed agreement (sending the system to a s/m only state) or VSEL can reject its element of the offer, sending (perhaps temporarily) BAe to a state where it only has an agreement on the frigate with GEC (frigate only).

Motivated power matrix

In accordance with the Powergraph procedure, each transition is then examined to determine whether the participants who have influence according to Table 19 are motivated to bring that about according to the preference ordering of Table 18. The effect of such consideration is to reduce the complexity of the boolean expressions by virtue of the setting to a value of 0 those variable in each transition expression which are associated with a participant who has the power (and therefore appears in the transition expression) but who does not have the motivation (since the terminus state is preferred less than the source state). This leads to the matrix of Table 20.

<i>Motivated power matrix for Trafalgar exercise</i>							
	start	split	s/m only	frigate only	VSEL alliance	GEC alliance	freeze out
start	B	B	B	B	B	B	\
split	\	B.V.G	G	V	\	\	V.G
s/m only	\	\	B.V.G	\	V	\	V
frigate only	\	\	\	B.V.G	\	\	\
VSEL alliance	\	\	\	\	B.V	\	\
GEC alliance	\	\	\	\	\	B.G	\
freeze out	\	\	\	B.G	B.V	B.G	V.G

Table 20: Motivated power matrix for participants in Battle for Trafalgar

This matrix is equivalent to the transition diagram of Figure 32, in which the characteristics of the problem can begin to be seen and which are described below.

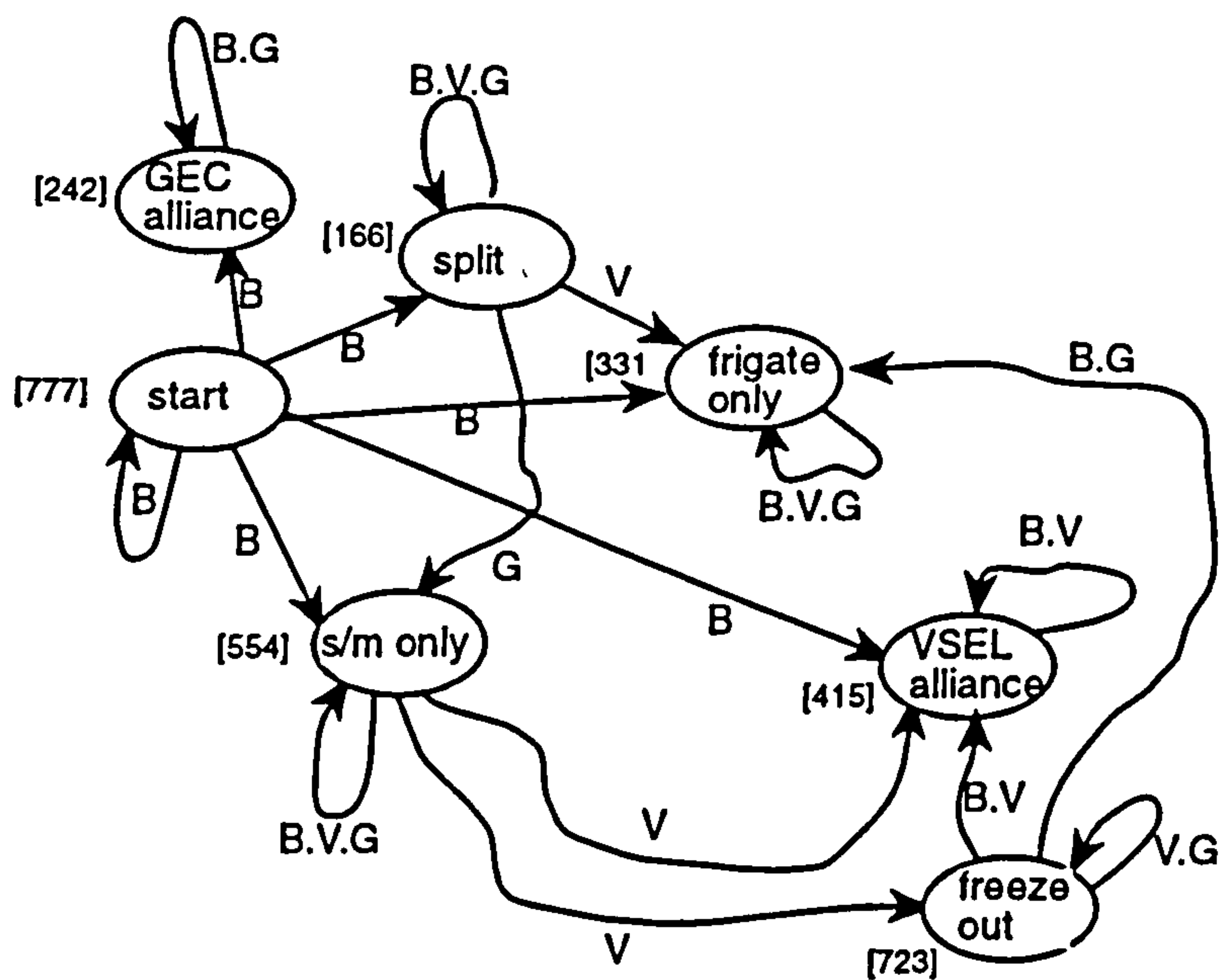


Figure 32: Transition diagram for Battle for Trafalgar problem

Analysis of the Directed Graph

The output of the Powergraph procedure is, equivalently, the motivated power matrix or the directed graph. This section deals with the existing heuristics and more formal results which assist in determining the behavioural conclusions from the directed graph in particular. First, however, it is noted that the scope of such an analysis is necessarily limited.

The Powergraph directed graph is an example of a deterministic graph game (DGG), first discussed by Washburn (1990). Alpern (1993) describes such games as being '*directed graph analogues of perfect information finite tree games*', where cycling is allowed between the defined states. There are two types of pay-offs, terminal (Washburn, 1990) and time-averaged (Alpern, 1991). In the former case, referred to as DGT games, the payoff accrues only when a terminal state is achieved, and in the latter, referred to as DGA games, the payoff is averaged over the pay-offs met at the locations visited in the trajectory of the game. Powergraph directed graphs are thus terminal payoff games or DGTs.

Alpern (1993) observes that a DGG can be rewritten as an infinite, extensive-form tree. There exists for each two person zero-sum game a pure optimal strategy determinable in polynomial time relative to the number of nodes of the graph (Washburn, 1990). We are

not concerned here, however, with zero-sum two person games. The general case for conflict analysis has more than two players and pay-offs which are terminal, differently perceived by players and non-zero-sum. There is no available theory to support analysis of such graphs and we are thrown back on an essentially heuristic approach which mirrors that of Fraser and Hipel and of Howard.

Analysis of Options Approach

Fraser and Hipel (1984, pp214-215) approach the problem of equilibrium in a similar way to Howard (1971) by dividing the equilibrium characteristics of a given state into three types of equilibrium, distinguished by the type of rationality associated with them. The associated figures (33 to 35) show the situation under the Powergraph diagrammatic convention.

Rational outcomes occur when no unilateral improvement exists for any player.

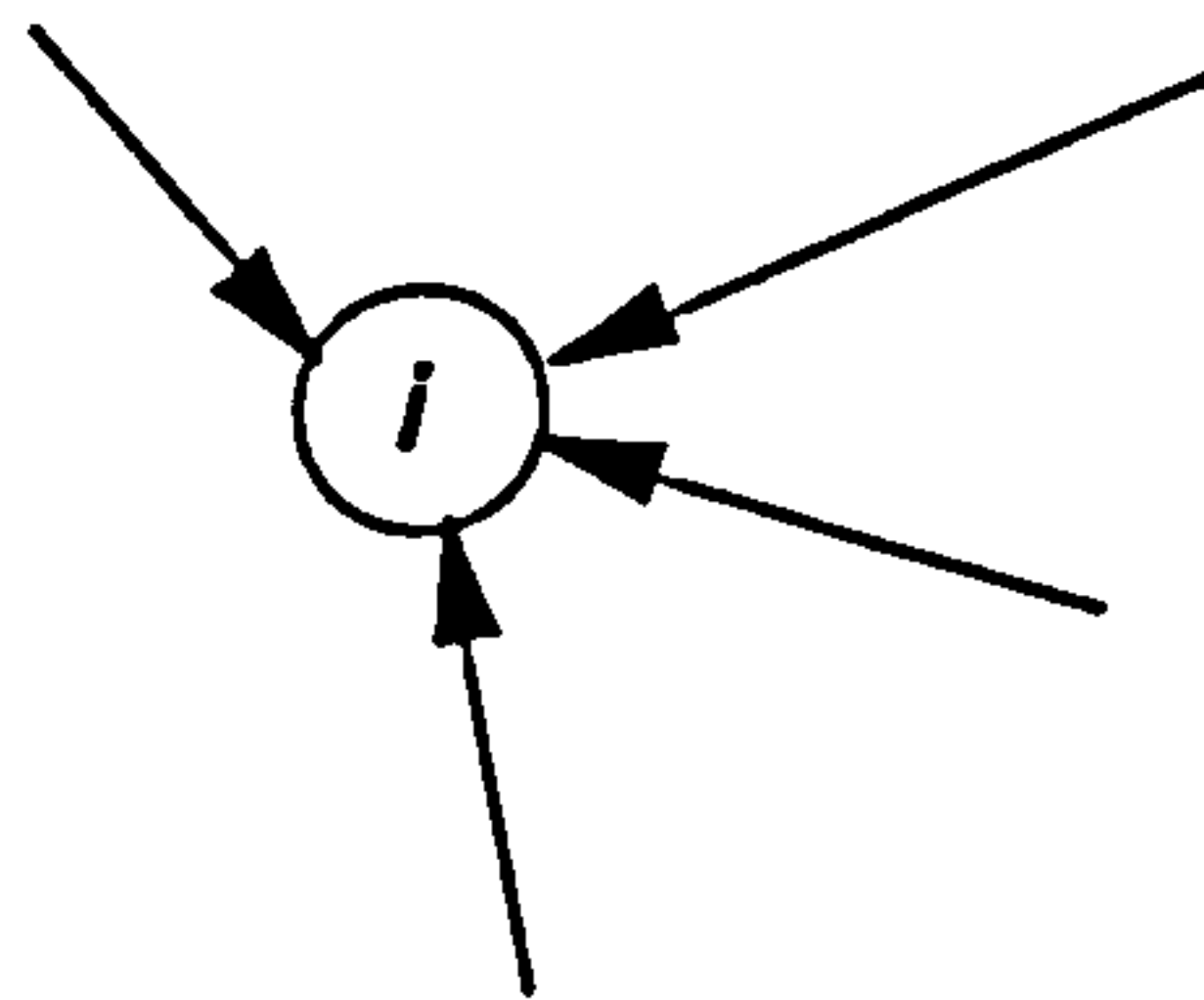


Figure 33: No path leads from state i; it is therefore a rational outcome

Symmetric metarational outcomes occur when although one player has a UI from a state (and should myopically, therefore, move) other players can act, in pursuing their own interests so that the game will subsequently arrive at a place less desired by the first player. It is, thus, not in the interests of the first player to move since she will subsequently be disadvantaged. This is referred to as a **sanctioning** of A's UI by the threat of B's subsequent (self-interested) action.

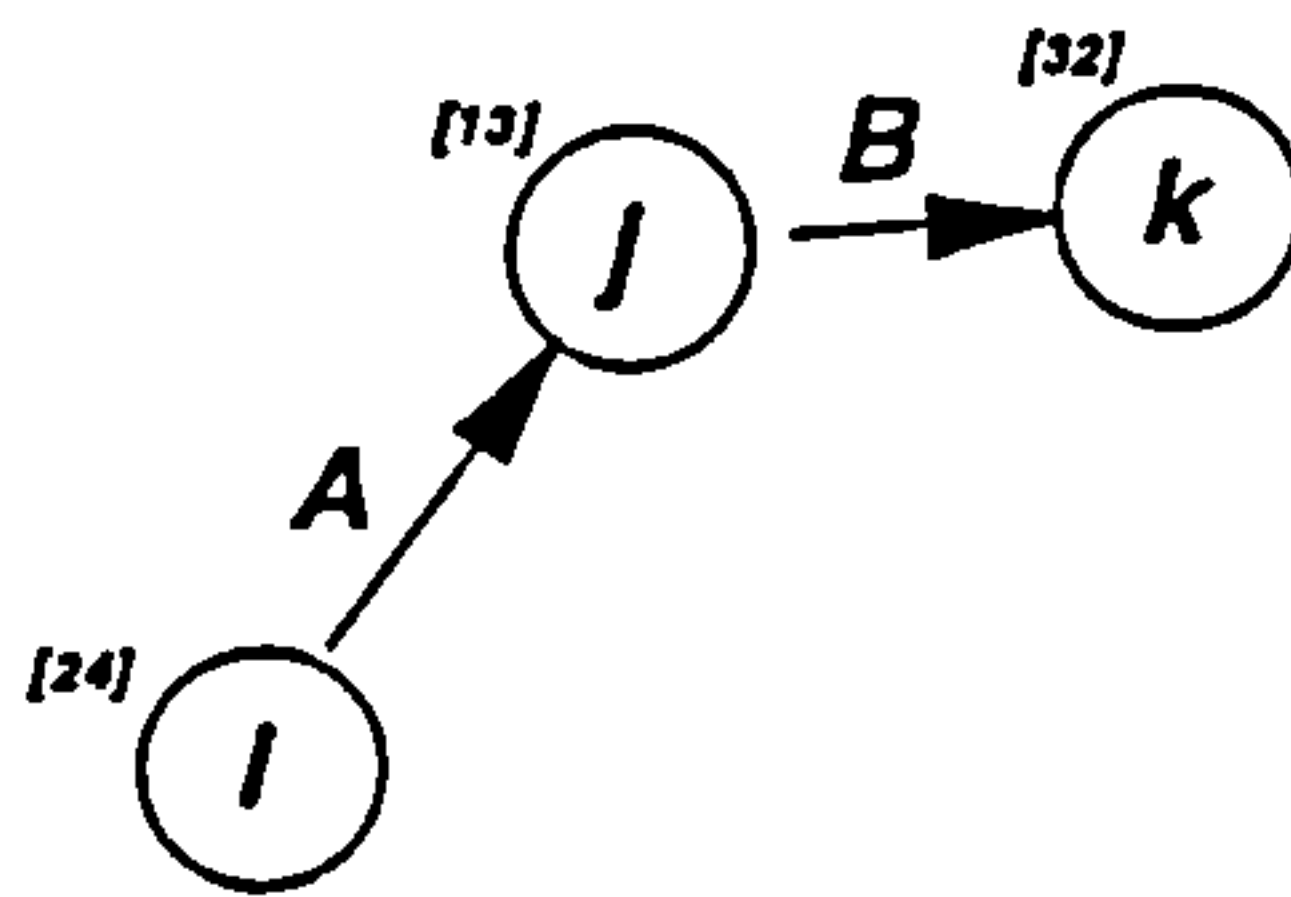


Figure 34: A is sanctioned by B's subsequent transition

General metarational outcomes occur when a player has a UI away from a state, other players then choose a joint strategy and subsequently the first player can move again to a state he prefers. Such a process can continue indefinitely and in Fraser and Hipel's phrase (op. cit, p215) '*it might [sic] be better for the particular player to remain with the original outcome.*' This can be seen as a neutralisation of the sanctioning process of the symmetric rationality above by the inescapable improvement offered by A's second move. Again, all players act in a locally self-interested fashion.

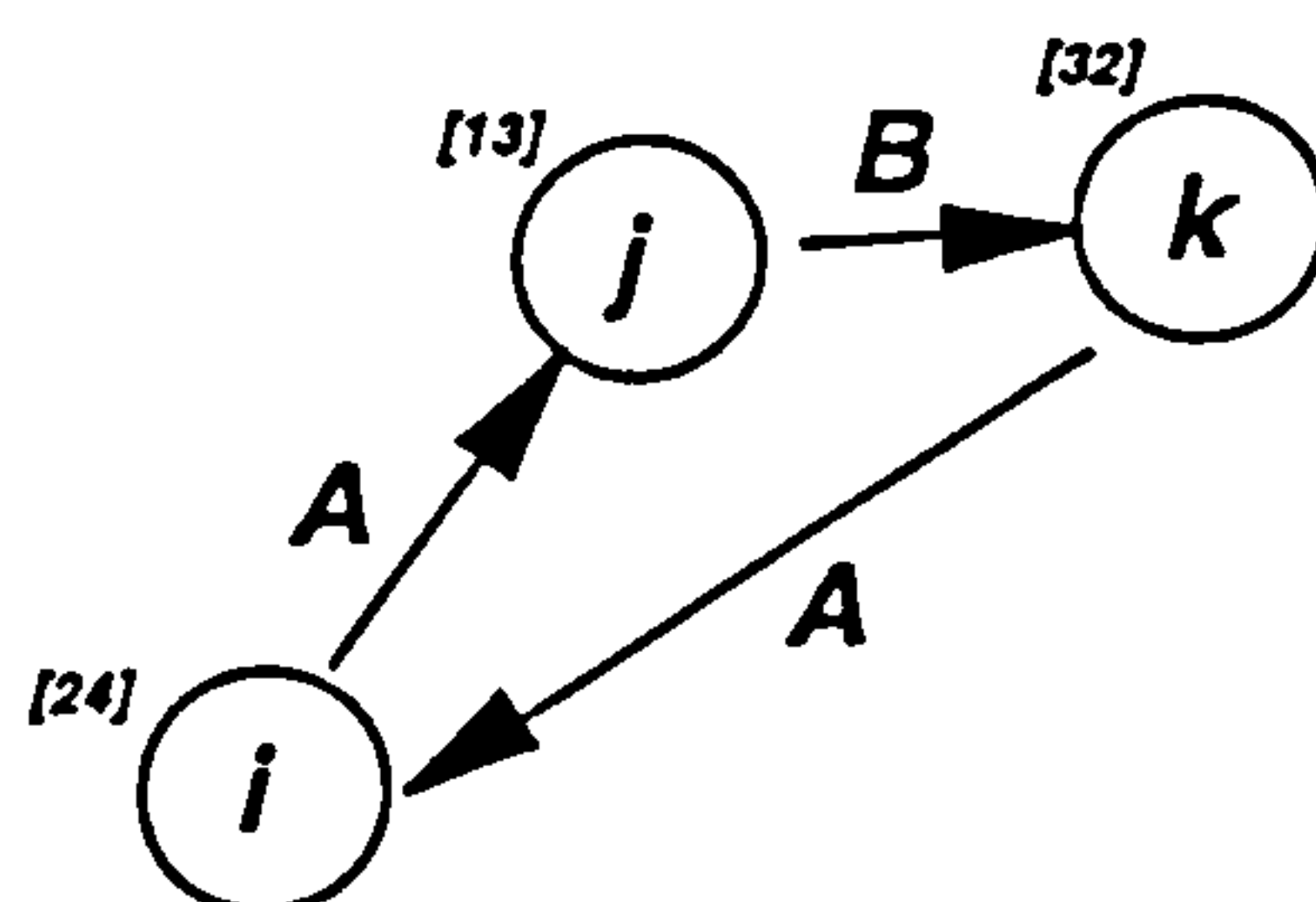


Figure 35: General metarationality; A can improve to a third state (here the original one, i)

This taxonomy is used as the basis for an equilibrium analysis procedure, suitably extended to encompass the multi-player control of the transitions, and with this structure in mind, the procedure for relaxation of the directed graph is as follows.

- 1) Determine the start position.
- 2) Delete from the diagram any state other than the start state which has no arrow into it.
- 3) Repeat step 2 until all states are accessible.
- 4) **Rational Outcomes:** Identify any states which have no arrow leaving

them. These are **rational outcomes** and the resultant graph, known as the **1-step graph** identifies those transitions which are both empowered and motivated from the point of view of the players.

This graph represents the possible trajectories which the situation will follow when each player considers only his own motivation one step at a time. By extension of the Fraser and Hipel taxonomy above, however, we see that certain 2-step paths may result in an outcome less desired by the players than the origin state. In other words, some transitions may result in a temporary improvement which can be denied by other players acting in their own self-interests. This is the symmetric metarationality case described above.

5) Identify Sanctioned States (Symmetric rationality): In the 1-step graph, examine each pair of successive transitions (from state i to state j to state k , for all i, j and k) from each player's point of view. If the utility of state k is less than the utility of state i and the player in question has no control over the transition $j > k$, that player will not be motivated to bring about the transition $i > j$ because transition $j > k$ will result in an overall fall in utility (over the two steps). Set that player's variable in the boolean expression for $i > j$ to logic value 0.

The phrase 'has no control over the transition $j > k$ ' demands explanation. It is not simply a matter of whether the player's variable appears in the boolean expression describing the power over the transition $j > k$. If the boolean expression for transition $j > k$ is of the form $P \cdot \phi$ where P is player P 's boolean variable and ϕ represents any boolean expression, P can clearly control whether or not the transition takes place in spite of any other players' desire. In any other circumstance player P will be partly under the control of the other players in respect of this transition.

6) Identify inescapable improvements (General Rationality): For each sanctioned path identified above, determine if an inescapable improvement exists by tracing possible paths away from the state j above.

It will be seen that the above procedure drives out metarationality at the 2-step level.

General metarationality requires a N-step approach, a more demanding requirement reflected in the weak phraseology of Fraser and Hipel (quoted above). Even in the simplified grammar of their diagrams N-step motivations are difficult to uncover, and their approach is, in the end, largely by inspection. Annex C to this work gives a set of theorems on which basis the boolean matrices of Powergraph can be manipulated in order to generate N-step motivated transitions. They indicate the feasibility of a computer-based decision support which may be a useful practical extension of this work, but, perhaps more importantly indicate that the necessarily myopic approaches of Fraser and Hipel and of Howard (which this work shares) may not be an essential limitation in the future. Figure 36 (Fraser and Hipel, 1984, p217) summarises their approach, and it should be noted that while the term 'Inescapable Sanction' is clearly defined the concept of 'Inescapable Improvement' which determines whether a state is general metarational for a player requires, similar to the Powergraph problem of N-step stability described above, an examination of an arbitrary number of transitions.

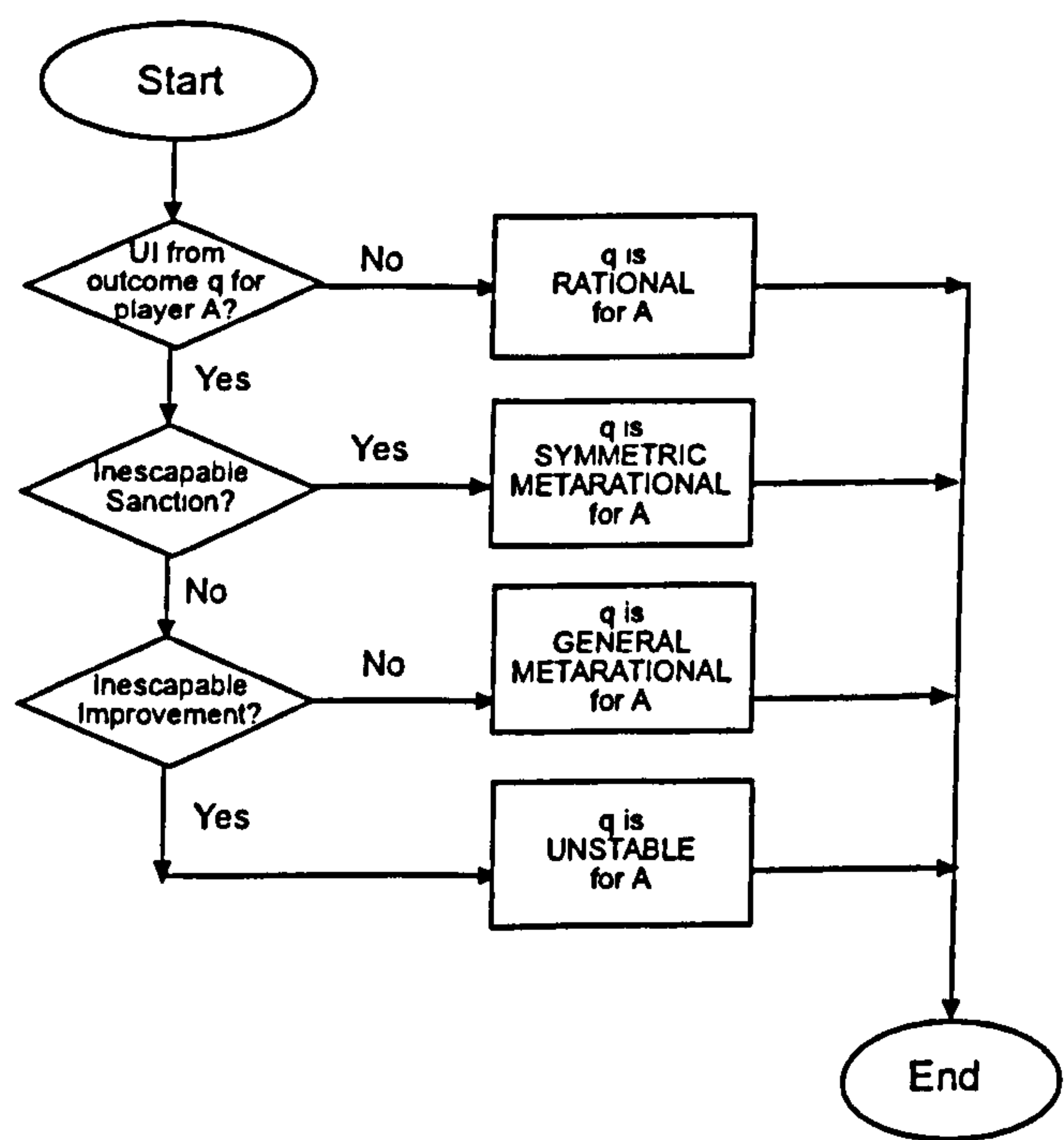


Figure 36: Algorithm for determining rationality of outcome (From Fraser and Hipel, 1984, p 217)

The equivalent algorithm for Powergraph is shown at Figure 37.

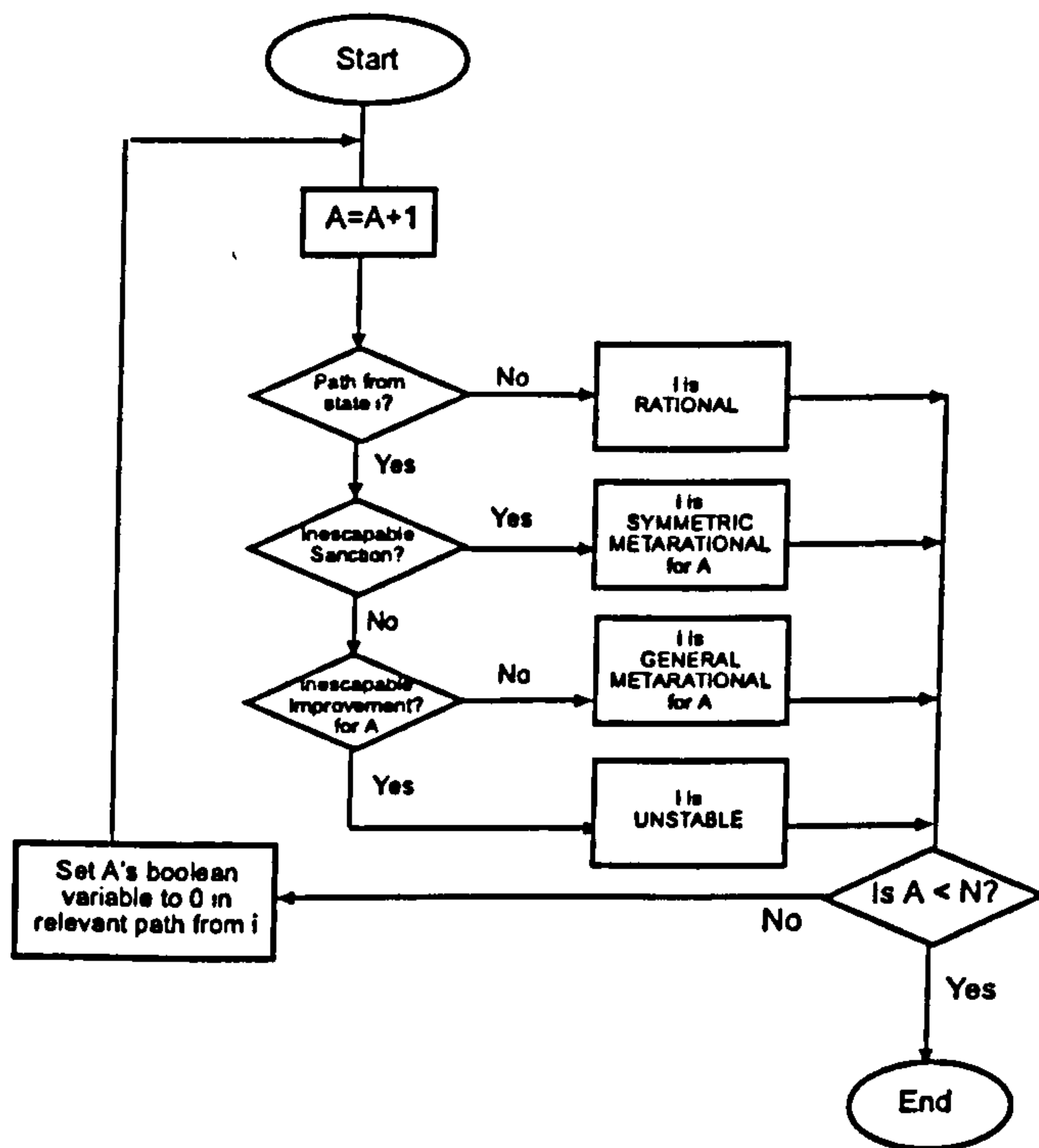


Figure 37: Powergraph stability algorithm

The example of *The Battle for Trafalgar* is now analysed according to the above procedure..

Figure 30 (repeated here for convenience) is the directed graph produced by the Powergraph procedure.

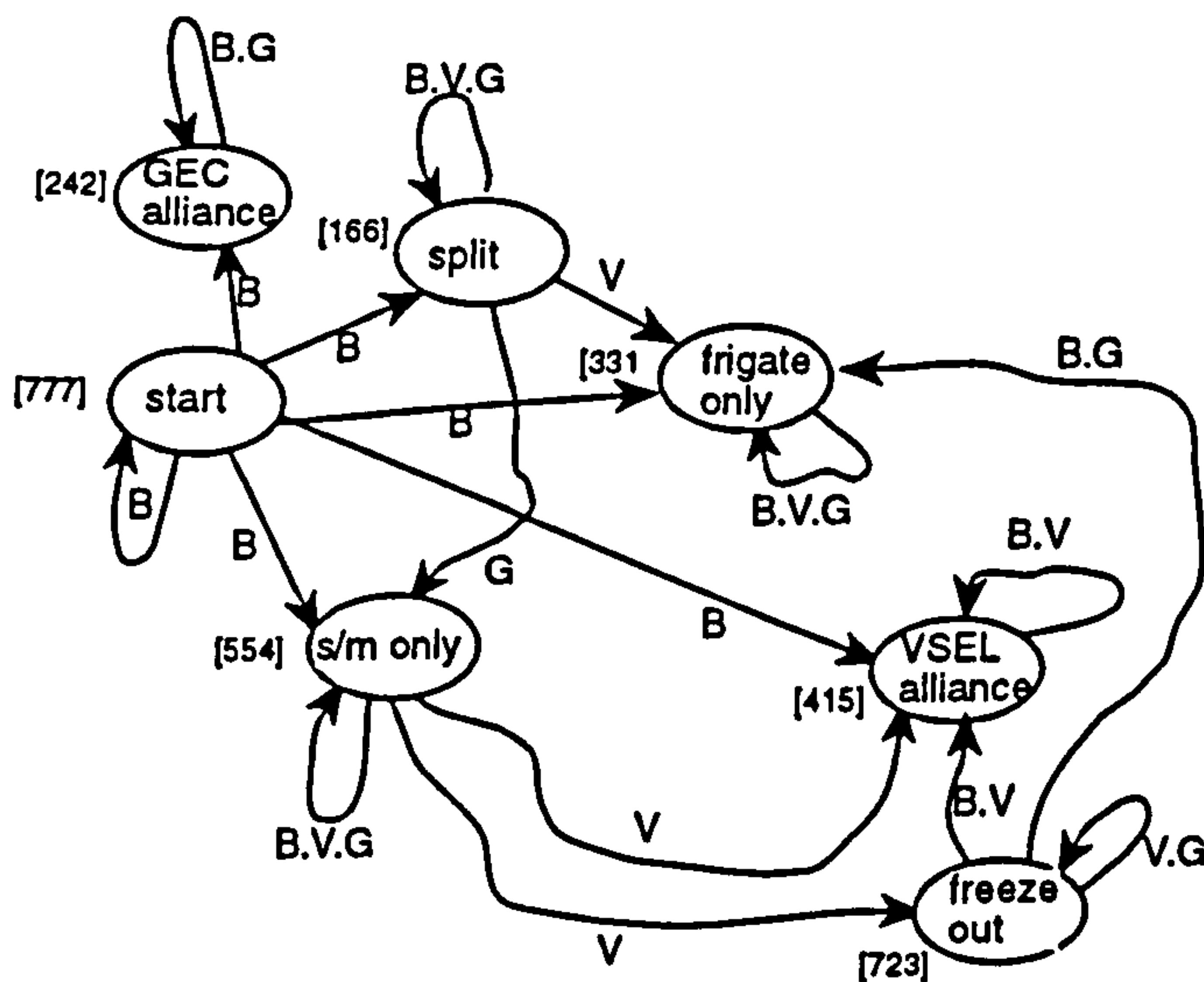


Figure 32 (bis): The Motivated Power Directed graph for Battle for Trafalgar

Inspection of the diagram shows that only the **Start** state has no path into it. This means that all the other states are potentially accessible.

Rational States:

States **GEC alliance**, **VSEL alliance** and **frigate only** are rational, since they have no paths out. They are shown here as shaded.

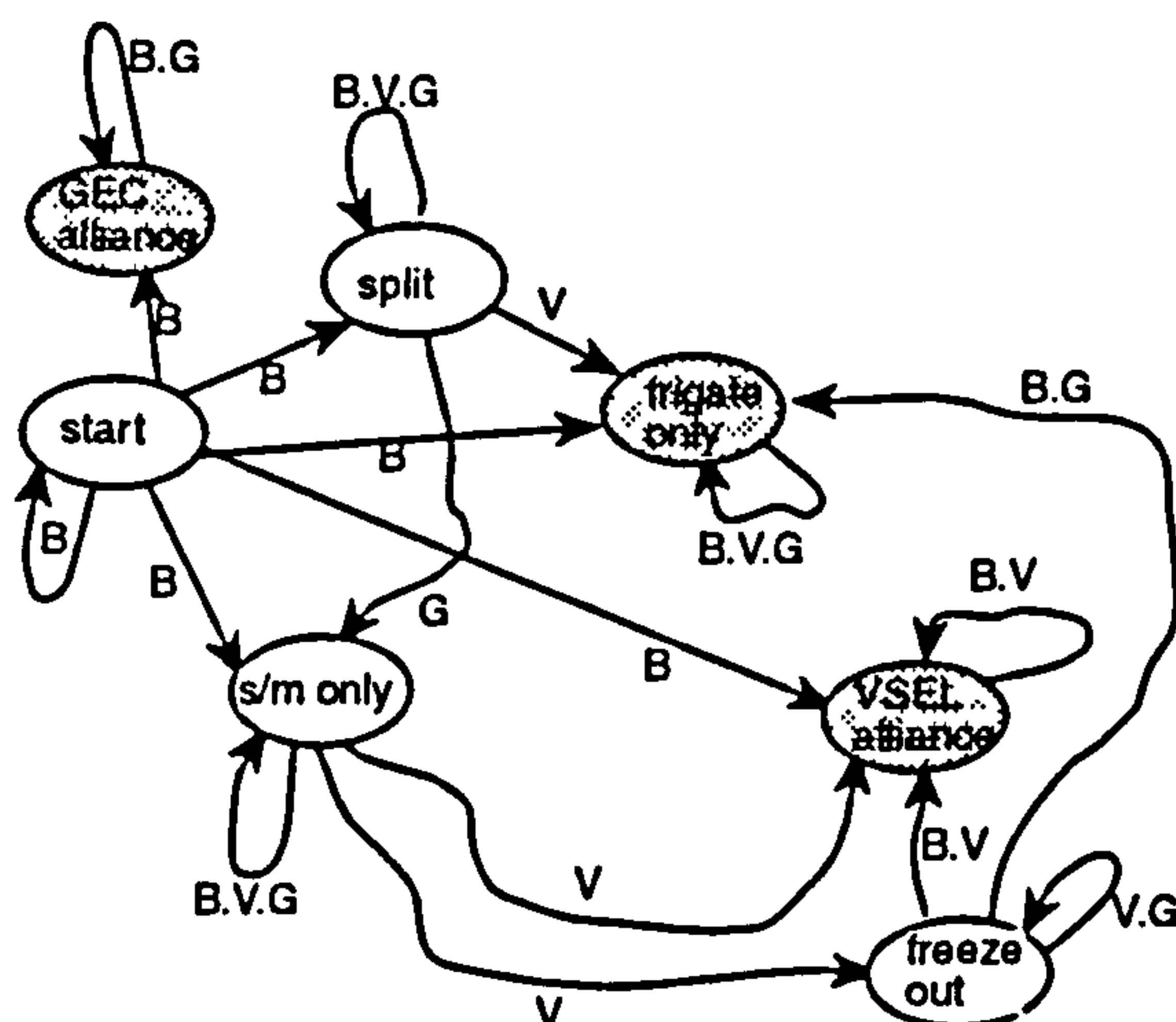


Figure 38: Rational outcomes in Battle for Trafalgar

We now have four remaining states to consider, with each of their transitions. These are **start**, **freeze out**, **s/m only** and **split**.

State **split** has two paths from it, **split** > **frigate only** and **split** > **s/m only**.

split > **frigate only** under the control of V, ends in an equilibrium (rational outcome). Hence it will be taken by V since no player will move from **frigate only** thereby reducing the utility from V's point of view.

split > **s/m only**, under the control of G, improves G's utility from 6 to 4, but path **s/m only** > **VSEL alliance** under the control of V would reduce G's utility from 4 at **s/m only** to 5 at **VSEL alliance**. As G's utility at **VSEL alliance** is better than at **split**, such a path would be, on balance, in G's interest even though G would prefer to stay at **s/m only**). A similar argument applies to the

path **s/m only** > **freeze out** also under the control of V, which results in a utility for G of 3, a better rank ordering than the utility at **split** which is only 6. Thus **split** is unstable.

State **s/m only** has two paths from it, **s/m only** > **freeze out** and **s/m only** > **VSEL alliance**.

s/m only > **freeze out**, under V's control, improves V's utility ordering from 5 to 2. From **freeze out**, however, there is a development path controlled by B.G to **frigate only**, which V likes less than **freeze out**, but not less than **s/m only**. Hence it does not sanction V's transition from **s/m only** to **freeze out**, and **s/m only** is unstable thereby.

s/m only > **VSEL alliance**, under the control of V, improves V's utility from 5 to 1 and puts the game into a rational outcome, from which no movement will result. Hence path **s/m only** > **VSEL alliance** would occur.

This last pair of transitions illustrates coincidentally the impact of the stability analysis on the order of play choice presented to V at the state **s/m only**. V has the choice of making two moves, and will base the choice (under conditions of perfect rationality) on the terminal pay off. Here the choice of **VSEL alliance** would be made since the **frigate only** utility order for VSEL is 3 as opposed to 1 in the other path.

State **freeze out** has only one path out to a rational outcome (equilibrium) and hence is unstable.

State **start** has 4 paths out, namely **start** > **split**, **start** > **frigate only**, **start** > **s/m only** and **start** > **VSEL alliance**.

start > **split**, under the control of B leads to an initial improvement of utility from 7 to 1, but is subject to V's movement from **split** to **frigate only**, which leaves B's utility at 3. While this is less advantageous than the utility at **split**, it is better than the utility at **start**, and hence does not constitute a sanction. In fact, since **start** has a utility of ordering of 7, the worst in B's eyes, no sanction can be invoked, since no threat can be worse than the utility at state **start**. This applies then to the other three transitions, **start** > **frigate**, **start** > **s/m only** and

start > VSEL alliance

Discussion of transition diagram

Having identified the rational states (equilibriums) a more interpretative analysis follows.

The process is essentially one of rehearsing the consequences of taking available choices at each of the states where more than one transition is available.

The transition diagram shows that BAe starts the process by offering one of the teaming choices.

Case 1 - BAe offers the split

Here, simultaneously (or, equivalently, without mutual knowledge) BAe offers the teaming with GEC on the frigate and with VSEL on the submarine. Either VSEL can take them to position frigate only by rejecting the advance, or GEC can take them to position s/m only by rejecting the advance. It depends who is quickest to become dissatisfied (or to rationalise their dissatisfaction) with the offer. What the diagram shows clearly is that because of the motivations of the players the direct consequence of moving to split is that BAe will either be taken to frigate only or to s/m only, neither of which it has preference for. Figure 39 shows the reduced diagram when BAe moves to state split.

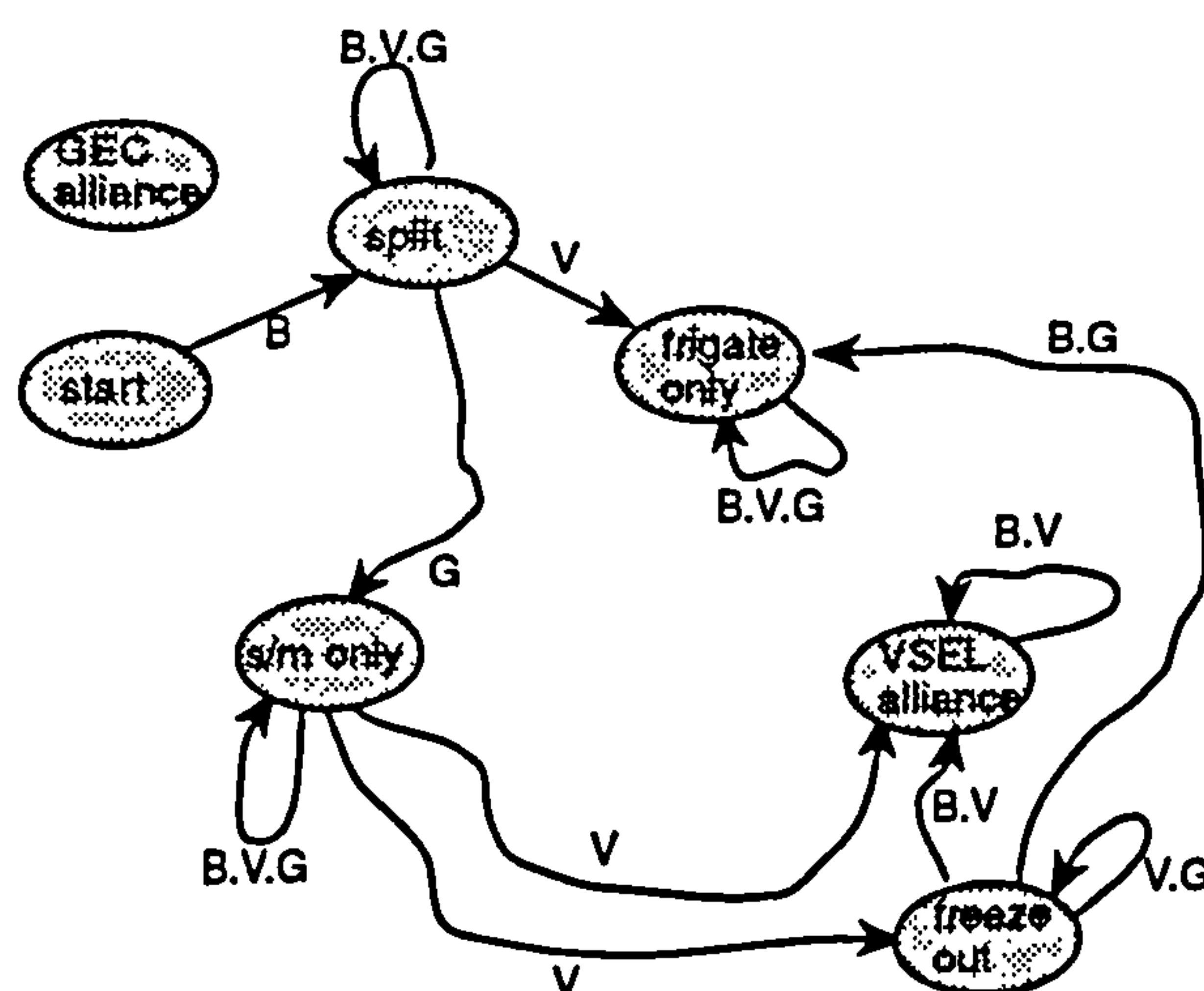


Figure 39: Transition diagram after BAe has offered a frigate position to GEC and a submarine position to VSEL.

We can see (Figure 40) that if V rejects the offer the resultant state frigate only is stable,

since there are no routes out of it. Similarly (Figure 41), if the state s/m only is brought about by GEC's rejecting the BAe offer, VSEL is put in control, and, according to its whim, can either offer a full alliance, replacing GEC as BAe's frigate partner, or can offer BAe the distasteful prospect of being shut out completely (state freeze out). In this latter case BAe will restart conversation with GEC in order to recover state frigate only, this requiring BAe to initiate those conversations, and GEC to be compliant.

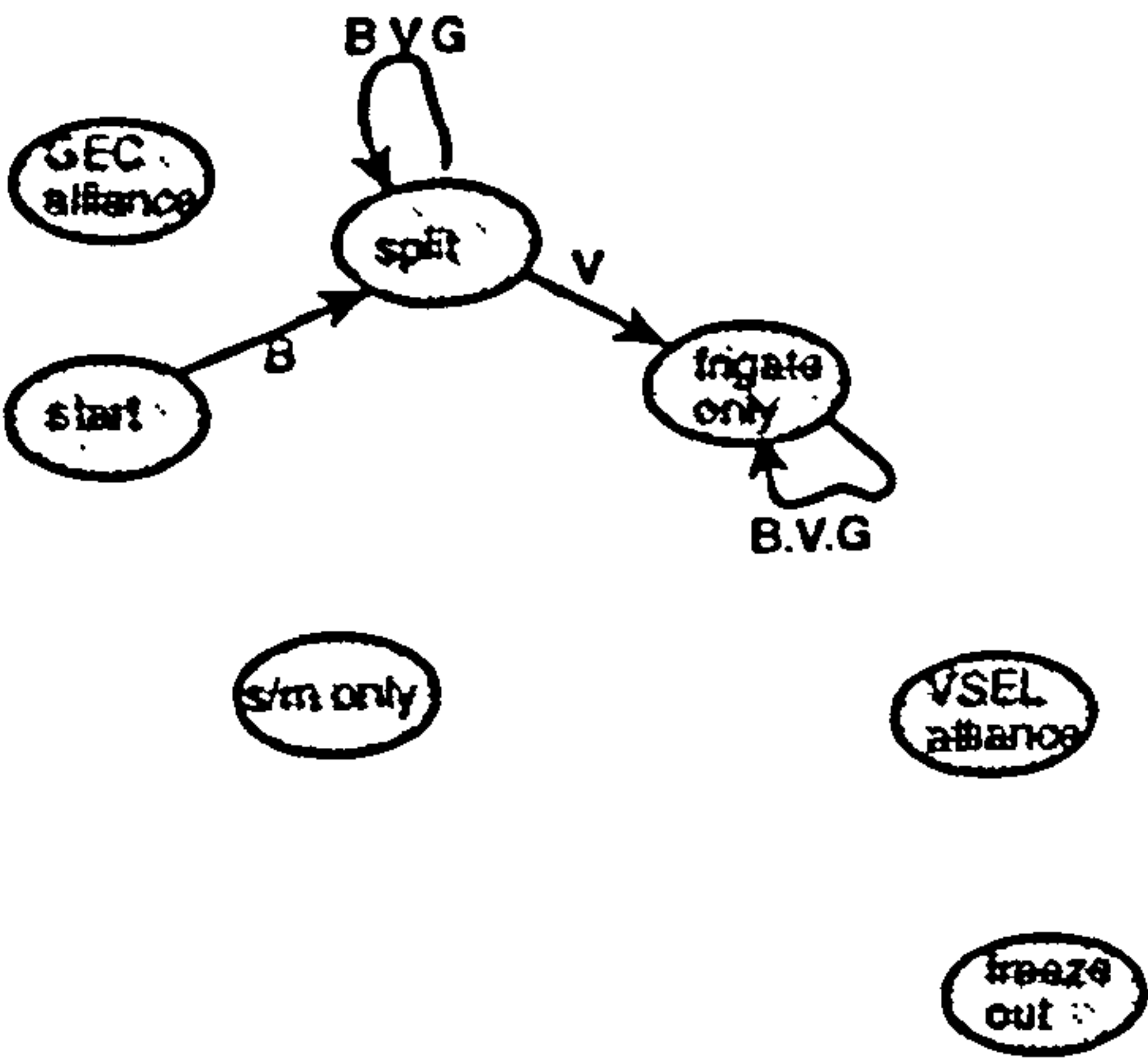


Figure 40 : VSEL reacts to the BAe offer

Case 2 - BAe offers to team on the frigate only

Here the state arrived at is frigate only which, as described above, is stable. GEC is likely to accept the offer.

Case 3 - BAe offers to team on the submarine only

Here VSEL are subsequently put in charge and can either decide to shut out BAe or to ally, as discussed above.

Case 4 - BAe offers full alliance to GEC

The state GEC alliance has no paths leading from it, and therefore is likely to persist. GEC accepts the offer.

Case 5 - BAe offers full alliance with VSEL

Similar to the case above, VSEL is likely to accept the offer, since there are no paths leading from the state VSEL alliance.

BAe, therefore must come to the conclusion (See Figure 39) that if it plays the 'split the pair' tactic,

- a) BAe will immediately hand control over either to GEC or to VSEL
- b) the best outcome that can emerge is an alliance with VSEL, with the very real danger that VSEL will shut them out. Examination of the preferences of VSEL will indicate which is the more likely.
- c) If VSEL take exception to being treated as an expedient, the result will be a position on the frigate alone.

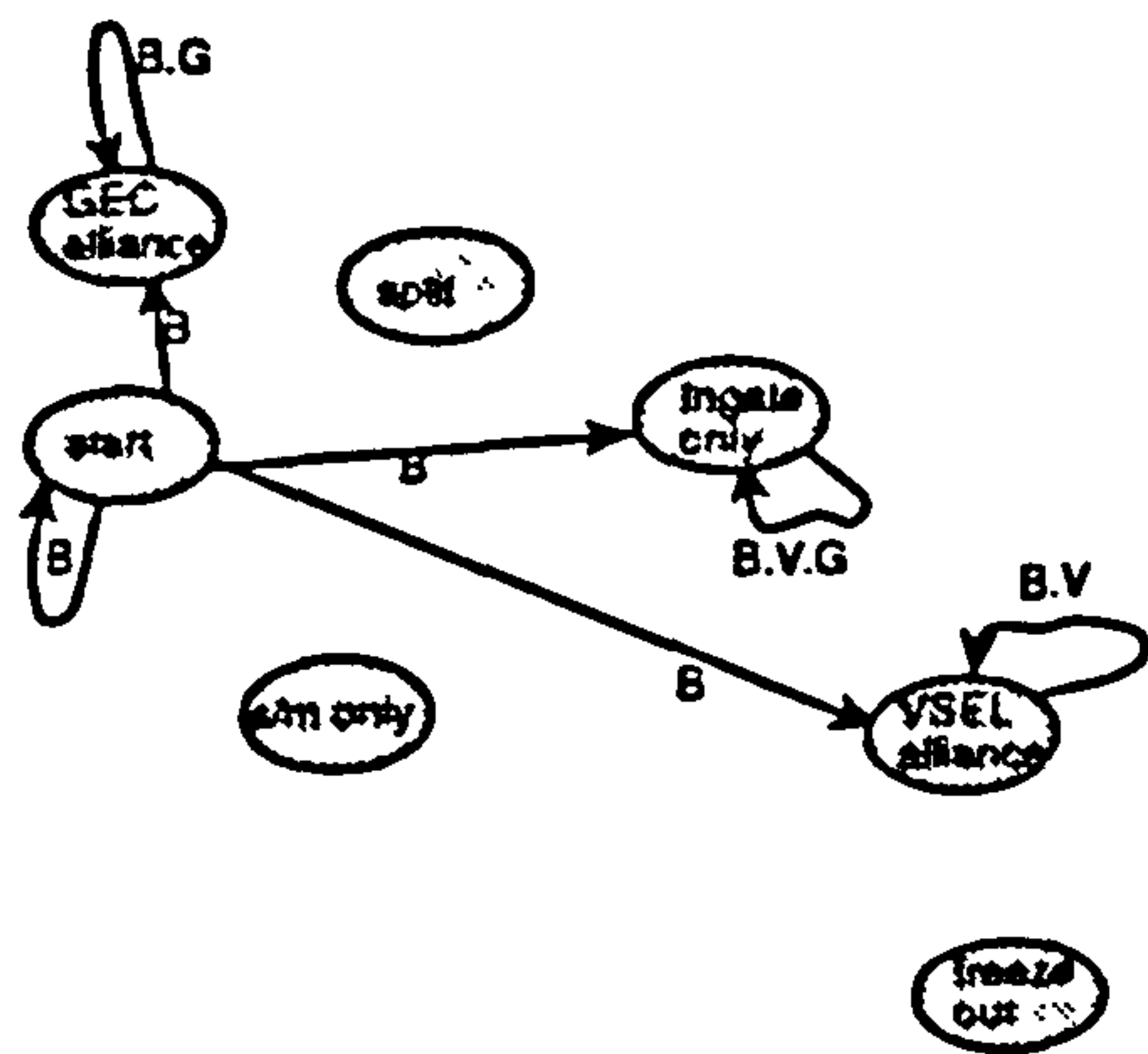


Figure 41: Preferred tactics for BAe

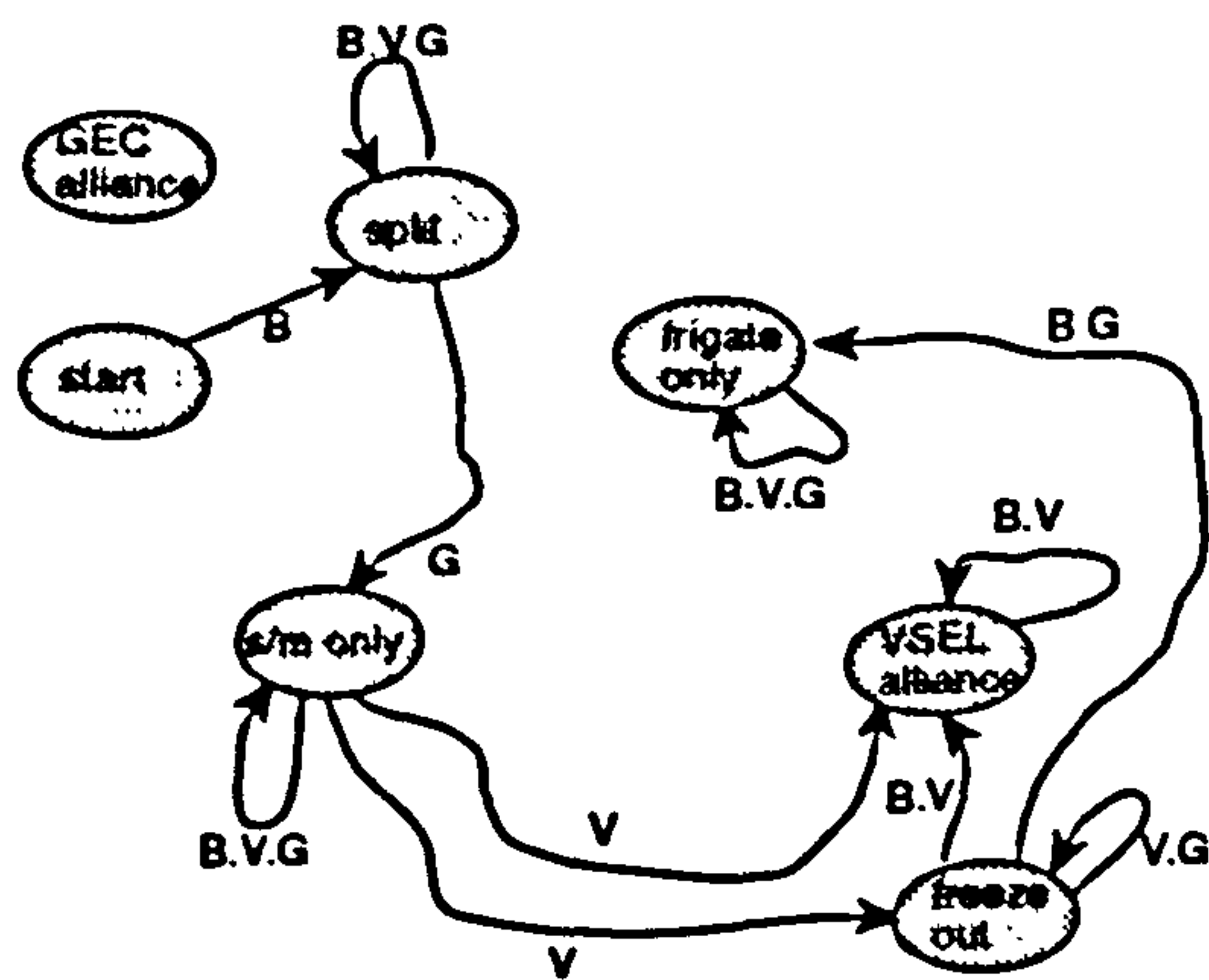


Figure 42:
The situation if GEC rejects the proposed BAe offer to split the projects
Hence, on examination of the consequences of the tactical choices, BAe would be better offering an alliance to GEC from the start, since the indications are that GEC would not

have the motivation to renege on such a deal. See Figure 42 above.

What actually happened

The actual decision was that because of the weight of the argument that it made no sense to back a loser, and hence that supporting VSEL on the frigate and/or GEC on the submarine, an offer would be made to GEC to support them on the frigate and to VSEL to support them on the submarine (i.e. to 'split the pair'). GEC was duly informed and considered their position, keeping their powder dry until negotiation on the workshare could be started. At a professional institution dinner that same night, the managing director of the relevant BAe division informed his counterpart in VSEL of the good news; BAe had decided to support VSEL in their submarine bid, but, understandably, felt that it made no sense other than to support GEC in their frigate bid, bearing in mind the formidable track record in their favour.

The VSEL MD was incensed. Calling his Chief Executive over to join the conversation, he informed the BAe MD that VSEL was not prepared to allow BAe to take workshare from the submarine programme (which VSEL already considered theirs for the taking) if BAe was not prepared to offer any assistance in the face of a threat to VSEL's very existence. The dockyard at Barrow needed the frigate work for its future survival. BAe had, they considered, reneged on an already done deal.

Diplomatic relations were broken off and BAe and GEC beat out a deal on the frigate. It was not favourable to BAe, but how could it be? After all, they were now playing on GEC's territory and it was clear that there was no retreat to a submarine position with VSEL.

BAe's only recourse, eventually, was to attempt a buy of VSEL.

Shortly after the abortive attempt by BAe to buy out VSEL, the results of the competition for the submarine project between GEC (who now owned VSEL) and VSEL were announced.

GEC won on merit and price.

Comparison with Fraser and Hipel Approach: Analysis of Battle for Trafalgar

In order to provide a comparison with the existing approach the following analysis results from the use of the Fraser and Hipel approach to the case study Battle for Trafalgar, described above.

The players and their options

The participants in this alternative analysis of the battle for the frigate and submarine projects described in Powergraph terms above are the same as in that previous analysis. The Fraser and Hipel approach requires the tactical options for the players to be expressed as a set of bipolar choices which are described in Table 21 below.

Tactical options for Battle for Trafalgar	
BAe	Do frigate with GEC
	Do frigate with VSEL
	Do submarine with GEC
	Do submarine with VSEL
GEC	Do frigate with BAe
	Do frigate alone
	Do submarine with BAe
	Do submarine alone
VSEL	Do frigate with BAe
	Do frigate alone
	Do submarine with BAe
	Do submarine alone

Table 21: The tactical options for players in Battle for Trafalgar (Fraser and Hipel analysis)

Feasible Tactical Options

The next stage in the Fraser and Hipel analysis is to reject infeasible tactical options by considering the viability of options of tactics to and between the participants. For example, in this case BAe cannot do the frigate with both GEC and VSEL, and so any combinations having the appropriate entries will be rejected. An array of 0s and 1s is constructed, 1 indicating that the participant in question adopts that tactical choice and 0 indicating that the tactical choice is not taken up. Table 22 below shows the feasible choices remaining. The feasible individual tactical choices are now compared with those for other players in

Tactical options for Battle for Trafalgar (Players treated separately)															
BAe	Do frigate with GEC	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Do frigate with VSEL	0	0	0	0	1	1	1	0	0	1	1	1	1	1
	Do submarine with GEC	0	0	1	1	0	0	1	1	0	1	0	1	1	1
	Do submarine with VSEL	0	1	0	1	0	1	0	1	0	1	0	1	0	1
GEC			a	x1	b		c	x1			x1	x2	x2	x2	x1
	Do frigate with BAe	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Do frigate alone	0	0	0	0	1	1	1	0	0	0	1	1	1	1
	Do submarine with BAe	0	0	1	1	0	0	1	0	0	1	0	0	1	1
VSEL	Do submarine alone	0	1	0	1	0	1	0	1	0	1	0	1	0	1
		x3	x3	x3	x3	x3		x4	x3		x4	x3	x5	x5	x5
	Do frigate with BAe	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Do frigate alone	0	0	0	0	1	1	1	0	0	0	1	1	1	1
	Do submarine with BAe	0	0	1	1	0	0	1	1	0	1	0	0	1	1
	Do submarine alone	0	1	0	1	0	1	0	1	0	1	0	1	0	1
		x6	x6	x6	x6	x6		x8	x7		x8	x7	x9	x9	x8

Notes

Each player is treated separately, combinations of tactical choices made infeasible by conflicts between players are treated at the next stage.

Reasons for rejection are as follows

- a BAe's insistence that it will not do the submarine with GEC unless there is a quid pro quo on the frigate
- b BAe's insistence that it will not do the frigate with VSEL unless there is a quid pro quo on the submarine
- c Rejected by BAe board
- x1 The s/m cannot be done with both
- x2 The frigate cannot be done with both
- x3 GEC will bid the frigate
- x4 Submarine cannot be done with BAe and alone
- x5 Frigate cannot be done alone and with BAe
- x6 VSEL will bid the frigate
- x7 VSEL will bid the submarine
- x8 S/m cannot be done alone and with BAe
- x9 Frigate cannot be done alone and with BAe

Table 22: Feasible tactical options in Battle for Trafalgar

order to reject jointly infeasible tactical choices, i.e. choices of tactics which are infeasible because of interactions between players, for example, if BAe chooses to bid the submarine with VSEL but VSEL chooses to bid on its own.

The results of this are shown in Table 23 below.

Jointly feasible tactical options for Battle for Trafalgar							
		freeze-out	frigate only	GEC alliance	s/m only	split	VSEL alliance
BAe	Do frigate with GEC	0	1	1	0	1	0
	Do frigate with VSEL	0	0	0	0	0	1
	Do submarine with GEC	0	0	1	0	0	0
	Do submarine with VSEL	0	0	0	1	1	1
GEC	Do frigate with BAe	0	1	1	0	1	0
	Do frigate alone	1	0	0	1	0	1
	Do submarine with BAe	0	0	1	0	0	0
	Do submarine alone	1	1	0	1	1	1
VSEL	Do frigate with BAe	0	0	0	0	0	1
	Do frigate alone	1	1	1	1	1	0
	Do submarine with BAe	0	0	0	1	1	1
	Do submarine alone	1	1	1	0	0	0

Table 23 The remaining jointly feasible tactical options in Battle for Trafalgar.

Table 23 shows clearly that the states implicit in the Fraser and Hipel analysis are identical with those derived directly in the Powergraph approach except for the Start state. In this instance we should expect this because the basis for the definition of the states is limited to the particular choices made by the player B (BAe). This application of the Fraser and Hipel method shows how the future is defined by the tactical choices. If the tactical choices are not completely understood, however, inadequate representation of the states will result. Table 23 also shows the correspondence with the states used in the Powergraph analysis.

Unilateral Improvement Analysis

The next step in the Fraser and Hipel procedure is to identify Unilateral Improvements or UIs which are transitions between two states where a player is motivated to induce the transition and has the power to do so. The Fraser and Hipel interpretation of power in the transition is whether the player can, unilaterally, change his tactical choice without the choice of another player being altered. This is a most strict interpretation of the concept, and requires a player’s ability to induce a transition to be truly completely within his own

power. The procedure begins with a rank ordering of the states in preference order for each player as shown in Table 24 below:-

Rank ordering of players' preferences				
Name	Index	BAe	GEC	VSEL
Freeze-out	2720	6	3	2
frigate only	2705	3	2	3
GEC alliance	2645	2	1	4
s/m only	1704	5	4	5
split	1689	1	6	6
VSEL alliance	1450	4	5	1

Table 24 Preference ordering for Battle of Trafalgar

These preferences accord with Table 19 above. The preferences are reordered in compliance with the Fraser and Hipel index, which is a numerical device used by them to ease the tedious comparisons which an result from extensive tactical choices. The index is calculated by taking the decimal equivalent of the binary number which forms the ‘word’ of 0s and 1s describing the tactical choices which define each state. (Fraser and Hipel, 1984, pp14 -15)

Next the states are put in preference order for each player as shown in Table 25 below.

Search for UIs for BAe							
		split	GEC alliance	frigate only	VSEL alliance	s/m only	freeze-out
BAe	Do frigate with GEC	1	1	1	0	0	0
	Do frigate with VSEL	0	0	0	1	0	0
	Do submarine with GEC	0	1	0	0	0	0
	Do submanne with VSEL	1	0	0	1	1	0
GEC							
	Do frigate with BAe	1	1	1	0	0	0
	Do frigate alone	0	0	0	1	1	1
	Do submarine with BAe	0	1	0	0	0	0
VSEL	Do submarine alone	1	0	1	1	1	1
	Do frigate with BAe	0	0	0	1	0	0
	Do frigate alone	1	1	1	0	1	1
	Do submarine with BAe	1	0	0	1	1	0
	Do submarine alone	0	1	1	0	0	1

Table 25 Showing the preference vectors for BAe in an attempt to find Unilateral Improvements

The Fraser and Hipel method (and indeed that of Howard, on which their material is based) now requires unilateral improvements to be found. In Table 25, then, we examine each state in turn to discover whether another state differs from it only by our own choices, while the component of the defining word determined by other players’ choices remains the same.

It is here that the method fails, since no such state exists for BAe (nor for the other players). Hence there are no UIs and the conclusion of the Fraser and Hipel method is that all states are equally likely as equilibriums. This is not a satisfactory conclusion.

Why does the Fraser and Hipel method fail?

The fundamental difficulty lies with the constraint placed upon the method by the restriction to states based on mutually compatible tactical choices. This places a constraint on the effective power structure of the method, since it assumes that each transition has effectively to be agreed by both parties. This is not necessary in many cases. An example will serve to illustrate the point.

Consider the transition from the split state to the submarine only state (1704). In the real situation this transition is clearly in the power of GEC. An offer has been made to VSEL to bid the submarine and an offer has also been made to GEC to bid the frigate with them. In order to move to the submarine only state it is clearly necessary for GEC to reject the offer. Thus the transition is controlled exclusively by GEC. Fraser and Hipel, however offer a method which appears to require the compliance of BAe, since the tactical choices of the two must be compatible. This is clearly not an appropriate representation of the real life project situation.

Now, it is clearly possible to amend the Fraser and Hipel procedure to accommodate such effects, but the effect of this would be to bring it nearer to the approach of Powergraph, and, ultimately to the same assumptions about the need to address issues of which party has power over transitions directly rather than as a consequence of a procedural approach based on tactical choices.

Some Classical Problems

The game theory literature contains a number of exhaustively analysed stylised situations, among them being *The Prisoners' Dilemma*, *Battle of the Buddies* and *Chicken* (Fudenberg and Tirole, 1991; Gibbons, 1992; Heap and Varoufakis, 1995; Morris, 1992; Rasmusen, 1989), each of which has on occasions been used as a stylised framework for the study of conflict (Brodie, 1959; Ellsberg, 1959; Schelling, 1966; Rathjens, 1969; Jervis, 1984; DeNardo, 1995). This section describes the Powergraph analysis of these three important games in order

- a) to show that the conclusions of this literature are reflected by and included in the Powergraph analysis
- b) to provide further material for the subsequent explanation of the methods used to analyse the directed graphs
- c) to provide further examples of the use of Powergraph

The Prisoners Dilemma

No game has received more attention from game theorists than the Prisoners' Dilemma, or PD. It concerns two prisoners who are arrested and put in separate cells. They can choose either to cooperate (i.e. to keep trust with another) or to defect (or betray the partner in crime). It is made clear to both prisoners that if they should turn Queen's evidence on their colleague, then they should expect to receive a certain leniency from the court, while the criminal colleague receives the full measure of the law. Of course if neither turns evidence on the other, both will do well, since the court will have insufficient evidence and they will benefit to the tune of their illegal profits. Lastly, it will be clear that it will be to neither's advantage if both turn evidence since then both will be found guilty, but it is more hurtful to each one if the other (alone) turns evidence, leaving his colleague to face the charges alone. This is often expressed as a bi-matrix of pay-offs (Morris, 1992) thus:-

		B's Choice	
		Cooperate	Defect
A's Choice	Cooperate	(-2,-2)	(-10,-1)
	Defect	(-1,-10)	(-5,-5)

The convention here is that the pair (x,y) indicates the pay-offs to A and B respectively.

States

Conventionally, the four states of play in which the two players cooperate with one another or defect and bear witness against their partner in crime are denoted by a symbol such as CC or DC which indicate respectively that both cooperate or that A defects while B cooperates. We therefore define in the Powergraph procedure the following states:-

- CC Both players cooperate with one another, denying information to the police
- CD While A keeps silent, B reveals his evidence to the police
- DC B is silent and A gives evidence
- DD Both tell what they know.

We note here that in this artificial example the states are adequately and unusually defined by the tactical choices alone. One can view them, however, either as a set of implemented tactical choices by the two players (A chooses C and B chooses D) or as a description of a state of affairs (A is keeping quiet, B is stitching him up).

Rank ordering

The entries in Table 25 below show the rank ordering of the preferences of the states in the eyes of the players, A and B.

	A	B
CC	2	2
CD	4	1
DC	1	4
DD	3	3

Table 26: Preference ordering in Prisoners' Dilemma

Feasibility of transition

Examination of the feasibility of transitions between states leads to Table 27.

	<i>CC</i>	<i>CD</i>	<i>DC</i>	<i>DD</i>
<i>CC</i>	-	B	A	A.B
<i>CD</i>	B	-	A.B	A
<i>DC</i>	A	A.B	-	B
<i>DD</i>	A.B	A	B	-

Table 27: The feasibility of transition between states in Prisoners' Dilemma.

Motivated Power

We now apply the information in Table 26 to Table 27 to give the motivated power transition matrix of Table 28.

	<i>CC</i>	<i>CD</i>	<i>DC</i>	<i>DD</i>
<i>CC</i>	-	B	A	-
<i>CD</i>	-	-	-	A
<i>DC</i>	-	-	-	B
<i>DD</i>	A.B	-	-	-

Table 28: Motivated power marix for Prisoners' Dilemma

In constructing this matrix we apply the following procedure:-

Select a transition (say, CC to CD)

For each player who appears in the boolean expression for that transition in Table 27, determine using Table 26 whether the terminal state (here CD) is preferred to the source state (here CC)

If the player has the motivation to bring about the transition (the terminal state is preferred to the source state), we retain that player in the relevant boolean expression. (Here we find that player B is motivated to bring about the transition and so we enter B in the relevant cell of Table 28.)

Continue for each element of the boolean expression, deleting (or, to be more precise setting to logical 0), that element of the preference ordering associated with a player who has no motivation to make that transition.

Continue through the remaining cells of the feasibility matrix.

Figure 43 is a network representation of Table 28.

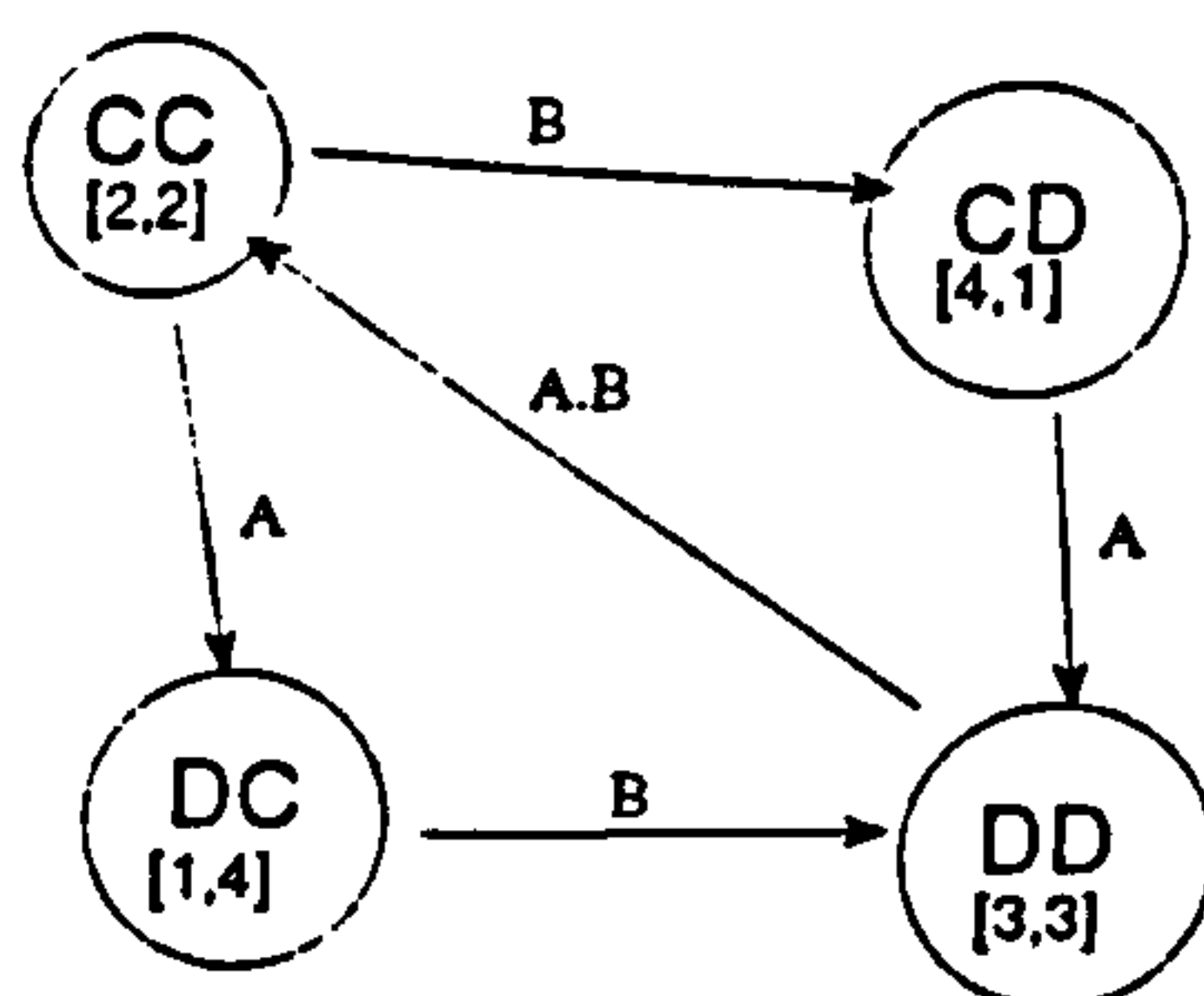


Figure 43: Transition graph for Prisoners' Dilemma

Figure 43, as should be expected, shows an exactly symmetrical graph, where, by two paths, A and B (or B and then A), acting entirely in their own localised interests, cannot help but gravitate to the state DD, and in order to recover to the jointly preferred CC, must cooperate in some way. It should be noted that the cooperation referred to here and in conventional game theory texts is not necessarily a communication contemporaneous with the problem, nor indeed an overt communication of any form. It could equally be a proper agreement that neither will talk at all, or (as in the case of military captives a schema by which only specific information will be released). More interesting is the emergent behaviour paradigm of criminals where 'grassing up' a colleague is deemed *de facto* to be unacceptable behaviour. Both cases are cooperation in the game theoretic sense.

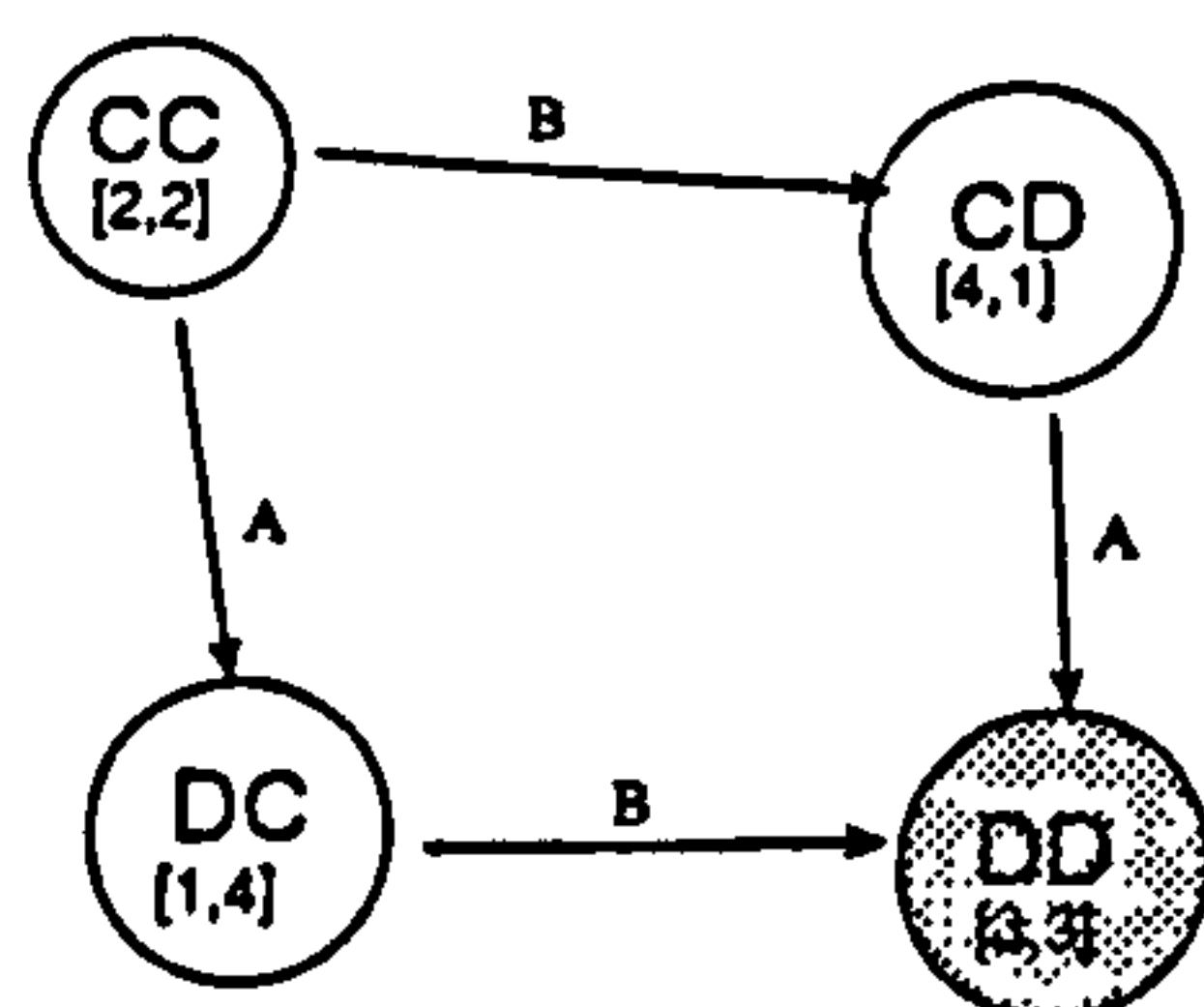


Figure 44: Gravitation to DD by applying localised self interest.

In this respect, then, the Powergraph treatment shows the classical result of the Prisoners' Dilemma treated as a noncooperative game (Morris, 1992, p127; Fudenberg and Tirole, 1993, pp9-10) in which the players have no option but to play DD. In Powergraph terms

the important phrase **non-cooperative game** would seem to mean that any path having **A.B** as its residual boolean expression cannot be implemented. Treated as a noncooperative game **A** and **B** cannot cooperate to bring about the effect of **A.B**. Such a development path would emerge from the action planning stage of Powergraph at which, having recognised that state **CC** is the best (for both players) each player would then determine what has to be done in order to ensure the successful pursuit of the path **CC** to **CD/DC** to **DD** to **CC**. At the point where the path element **DD** to **CC** was discussed it would be realised that the boolean expression **A.B** is, at best, jeopardised by the inability of the players to communicate.

At this point conventional game theory adopts the concept of a **cooperative game** in which *'the players are allowed to make binding agreements about which strategies to play'* (Morris, op. cit. p132). Under this assumption of cooperation, in this situation, **A** and **B** are deemed to have the ability to communicate and therefore come to a joint agreement that they are both better off standing by their protection of the other's interests. It will be seen that the Powergraph approach fully reflects the structural conclusions of the conventional game theory analysis.

A specific example of the symmetric rationality issues occurs in the Prisoners' Dilemma game, the graph of which is repeated here for convenience.

Here we see that when considering state **CC**, **A** has control over the transition **CC > DC** and **DC** has only one path out to **DD**. The transition **CC > DC** is therefore sanctioned by **B** in the transition **DC > DD** since **A** knows that if he takes option **DC** (i.e. defects), **B** will have no option but to take path **DC > DD**. State **CC** should, therefore never be taken by jointly rational players. The Prisoners' Dilemma also provides an illustration of general metarationality in that the recovery from **DD** to **CC** constitutes a general metarational justification of a player making a move **CC** to, say, **DC** if that constitutes a threat of remaining at **DD** which can be resolved by cooperative action subsequently.

Battle of the Buddies

The second of the three classical games treated here comparatively by the Powergraph approach is a game of cooperation between two friends who have different preferences for an evening's entertainment; one of them prefers to go to the ballet, while the other prefers watching wrestling. If they were not friends there would be no dilemma; each would go his own way. Here, however, they value one another's company, too, so that they would prefer to go to the same event rather than go to different ones.

The game is, again, covered extensively in the literature (Morris 1992, Fudenberg and Tyrole 1993), and is included here in order to show the ability of Powergraph to arrive at the results achieved by conventional game theory approaches.

Payoff Matrix and conventional treatment

Morris, (op cit. pp116, 117) offers the following as a suitable payoff bi-matrix to represent the dilemma of the two friends. A prefers the ballet, B the wrestling:-

		B's choice	
		Ballet	Wrestling
A's choice	Ballet	(5,1)	(0,0)
	Wrestling	(0,0)	(1,5)

Table 29: Payoffs for Battle of the Buddies

Treated as a noncooperative game (for example, if A and B announce their intentions irrevocably simultaneously), there is a mixed strategy solution, where each player chooses his own preferred choice with a probability of 5/6. This is not too helpful in practical terms, however.

The solution to which conventional game theory comes to is indeterminate and can be summarised as follows (Morris, op cit., p126)

1. A can choose always to offer the ballet. If B believes that A will never cooperate by choosing to go to the wrestling, then his best response is to choose the ballet himself. As Morris (ibid.) observes *'The success of this*

scenario requires a degree of stubbornness between [A] and [B]. Otherwise, by symmetry, [B] might persist in playing [wrestling].'

2. Neither player should play a random mixed strategy. In all cases there is a chance that either by design or by accident the other player will choose a response mixed strategy that does significantly worse for his friend.

3. A could choose wrestling. If B believed that A would continue with this he could respond by choosing wrestling. The result would be excellent for B and not bad for A. Symmetry again enters the problem, however, because if choosing his least preferred choice is good for A then choosing ballet is good for B and we may have the strange situation of each choosing the other's preferred option. *'That would be a rather comic turn of events, but the possibility of it does cast doubt on the idea'* (Morris, *ibid.*)

States of play

We commence with an analysis based on three states as follows:-

Start	No decision has been made; discussion continues as to the evening's entertainment
BB	Both go to the ballet
WW	Both go to the wrestling
Part	Go separate ways; disparity of choices (either order)

Preference Ordering

Table 30 below shows the preference ordering consistent with the payoff matrix for Battle of the Buddies.

	A	B
Start	4	4
BB	1	2
WW	2	1
Part	3	3

Table 30: Preference ordering for states of Battle of the Buddies

Note here that we are maintaining faith with the somewhat stylised scenario presented in the game theory representation by deliberately setting the preference of the start/unresolved state (Start) to bottom preference, 4, for both players. This ensures that both parties wish to leave the start state. We shall see below that there are other representations of the situation which comprehend extensions to the states and associated rank orderings of those states.

Feasibility Matrix

Table 31 below shows the feasibility of the various transitions.

Feasibility Matrix for Battle of the Buddies				
	Start	BB	WW	Part
Start	-	A.B	A.B	A.B
BB	-	-	-	A+B
WW	-	-	-	A+B
Part	-	B	A	A.B

Table 31, Feasibility of transitions in Battle of the Buddies

There are certain inherent assumptions in the matrix concerning the irrevocability of the decisions. Observe transition (Part, Part), which defines the ability of parties to prevent movement from the state Part (the sustainment power of the parties). We assume inherently, although it is not stated in the conventional description of the problem, that the decision to part is revocable, in that each party has the opportunity to defuse the disagreement by reversing his choice of event. Similarly, in the states WW and BB, we assume (quite arbitrarily, in fact) that once the parties have agreed they will not renege. This assumption could equally well be reversed, representing a different social situation. Similarly, we assume that once the Start state is left, the parties cannot revert to the state of indecision. This assumption is necessary not for the application of Powergraph, but to ensure that the representation achieved by Powergraph in this application is restricted in similar ways to that of the conventional representations.

Even at this preliminary stage of the analysis of a starkly stylised game, the Powergraph approach throws up, in a natural way, assumptions inherent in conventional representations and causes disciplined observation to be made of hitherto untested assumptions.

Motivated Power Matrix

The inclusion of the preference ordering into the feasibility matrix results in the following motivated power matrix, Table 32.

	<i>Start</i>	<i>BB</i>	<i>WW</i>	<i>Part</i>
<i>Start</i>	-	A.B	A.B	A.B
<i>BB</i>	-	-	-	-
<i>WW</i>	-	-	-	-
<i>Part</i>	-	B	A	A.B

Table 32: Motivated power matrix for Battle of the Buddies

Unusually we see here that no further constraint is placed on transition feasibility by the preferences of the players. The resulting transition graph is shown below as Figure 45.

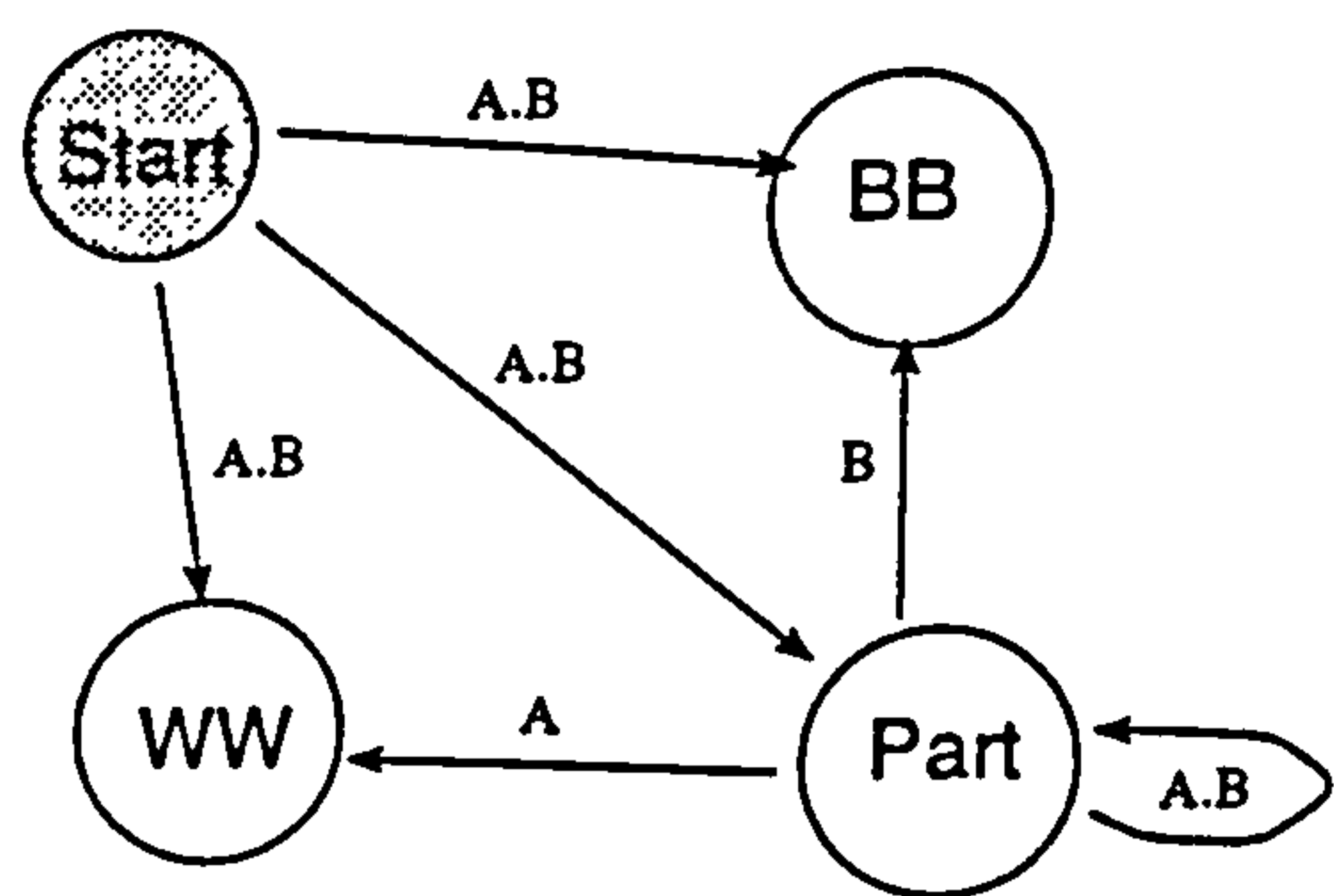


Figure 45: Directed graph for Battle of the Buddies

From the diagram we can see that there are two possible equilibriums (WW and BB). They are each reached in one of two ways. Either both parties agree straight away to go to the ballet (BB) or to the wrestling (WW) or they can, by acting selfishly in the first instance, offer a parting of the ways. That would take them to Part from which there are two paths, one under the control of A which ends at state WW, where A has given up his preference in order to enjoy the company of his friend, and one under the control of B which ends, symmetrically at BB. Note the significance of the sustainment power loop marked A.B associated with state Part. This is a statement of who has the power to hold the situation at state Part. We see that both A and B must act to keep the system at the least desirable state.

In summary the Powergraph procedure is telling us that there are essentially two solutions to the game, namely **BB** and **WW**. This is in complete accord with Morris' (1994) analysis, and mirrors the mechanisms he indicates, already quoted, in the following fashion. First, the bullying strategy where either player chooses his preferred event and the other reluctantly complies, is represented by the paths **Start > BB** and **Start > WW**. Morris (ibid.) calls into question the stability of such an equilibrium, pointing out that (in Powergraph vocabulary) both paths **Start>BB** and **Start>WW** are under the control of different parties. Additionally to Morris' analysis, then, we can state that the essential issue in determining which of **WW** or **BB** will be an equilibrium is the order of play at **Start**. In observing that the symmetry can be broken by a pre-declaration in this fashion by admitting the possibility that one player can have 'first shot' at determining the evening's entertainment we have already transcended the level of representation in the conventional game theoretic analysis. In practical business vocabulary we have an action plan emerging naturally from the Powergraph analysis which indicates a possibility of agreeing with our friend that, in order to maximise the joint return, we will toss a coin for the order of play. It is realised that this is tantamount to tossing a coin to decide which of the two events we should attend, but it represents a level of structural understanding of the problem arising from the Powergraph approach that is above that of the conventional analysis.

Second, Morris' 'comic' situation, quoted above, results from the lack of declaration of order of play at **Part**. If play is not ordered, there is the possibility that each player will see the improvement path to **WW** and **BB** respectively and will simultaneously take it, selflessly but vainly seeking a reconciliation. We sometimes see this in emotional arguments when the weighting of conflicting results characterised by 'having one's own way' and 'wanting not to fall out' change relative weighting as the consequences of failure to agree become more tangible. To put flesh on the Powergraph resolution of the Morris comic situation, we again consider the order of play, this time at **Part**, and see that a conditional agreement is needed such as, 'We'll say what we each want first, but one of must decide in that instance (or we'll be here all night!) We'll toss a coin to see who will decide.' Again at first

glance it appears to be a simple resolution of the dilemma by the tossing of a coin but underlying that resolution is a more realistic structural understanding of the powers and motivations in the conflict/ cooperation problem.

Last, Morris holds out no hope for a randomised game theoretic mixed strategy and neither does the Powergraph analysis.

As a final observation on the difficulty of determining a single, satisfactory solution for the Battle of the Buddies, it is inconceivable that any single equilibrium should emerge from any analysis since the game is exactly symmetrical for the two players. Powergraph, however, rather than accepting the situation as modelled, naturally leads the analyst into practical development paths aimed at resolving the situation.

Developed representation

In the previous analysis we were concerned mostly with accurately representing the situation described by the conventional analysis, and in so doing we observed that there were certain hidden assumptions therein. In order to indicate how the Powergraph approach can be used to extend this simple representation, the state definitions are now extended to cover reneging and 'agreements to disagree'. It should be noted that there is no implication that because then conventional analysis does not cover these more realistic situations that it is in any way defective in its analysis. The defect lies only with the speed and flexibility of representation and its propensity to generate richer representations, rather than with the correctness of the results.

Expanded List of States

In order to comprehend these other aspects of the likely situation we adopt an expanded list of states as follows:-

Start No decision has been reached, no offer made

Indecision No decision has been made, but at least one proposal has been made

WW Both agree to go to the wrestling

BB Both agree to go to the ballet

Part (+) Both agree to go to separate events

Part (-) No agreement has been reached, but both go to separate events anyway.

Preference Ordering II

Table 32 below shows the rank ordering of the states defined in the previous section.

	A	B
Start	6	6
Indecision	4	4
WW	2	1
BB	1	2
Part (+)	3	3
Part (-)	5	5

Table 33: Preference order for the participants in Battle of the Buddies

The preference expressed for **Start** must be the lowest for both parties, since it is pre-defined to be a state which cannot persist. Next liked in order for both players is the **Part (-)** state where they part on bad terms, having failed to achieve an agreement. The preference expressed for indecision requires careful treatment, since it is in fact time dependent; until time runs out (the shows are about to start) not deciding is better than **Part (-)**, but when time runs out no benefit will be gained and indecision becomes highly disliked. We will accommodate this singularity in our equilibrium analysis by assuming that at some point an appearance at **Indecision** becomes the last opportunity; on leaving **Indecision** at that time we cannot return to it. Another way of analysing the situation is to produce two different networks with the different preference ordering explicitly expressed. In this case the former method is easier. The remaining orderings are self-evident.

Feasibility Matrix II

Table 34 shows the feasibility of the transitions.

Feasibility Matrix for Battle of the Buddies II						
	Start	Indecision	BB	WW	Part (-)	Part (+)
Start	-	-	A.B	A.B	A.B	A.B
Indecision	-	A+B	A.B	A.B	A.B	A.B
BB	-	A+B	A.B	-	A+B	A+B
WW	-	A+B	-	A.B	A+B	A+B
Part (-)	-	A+B	B	A	A+B	A.B
Part (+)	-	-	B	A	A+B	A.B

Table 34: Feasibility matrix for Battle of Buddies II

The entries are largely self-explanatory, but note should be made of the inherent assumptions that either party can destabilise a situation (e.g. from Part (+) to Part (-)). Improvement from Part (-) to WW or BB is dependent upon the other party's agreeing to accept his less preferred option, so that Part (-) > BB is in the control of B but not A. Start cannot be reached from any other state.

Motivated Power Matrix II

Table 35 below shows the result of incorporating the preference ordering.

Motivated Power Matrix for Battle of the Buddies II						
	Start	Indecision	BB	WW	Part (-)	Part (+)
Start	-	-	A.B	A.B	A.B	A.B
Indecision	-	A+B	A.B	A.B	A.B	-
BB	-	-	A.B	-	-	-
WW	-	-	-	A.B	-	-
Part (-)	-	A+B	B	A	A+B	-
Part (+)	-	-	B	A	-	A.B

Table 35: Motivated power matrix for Battle of the Buddies II

The network diagram which is equivalent to Table 35 is shown as Figure 46 below

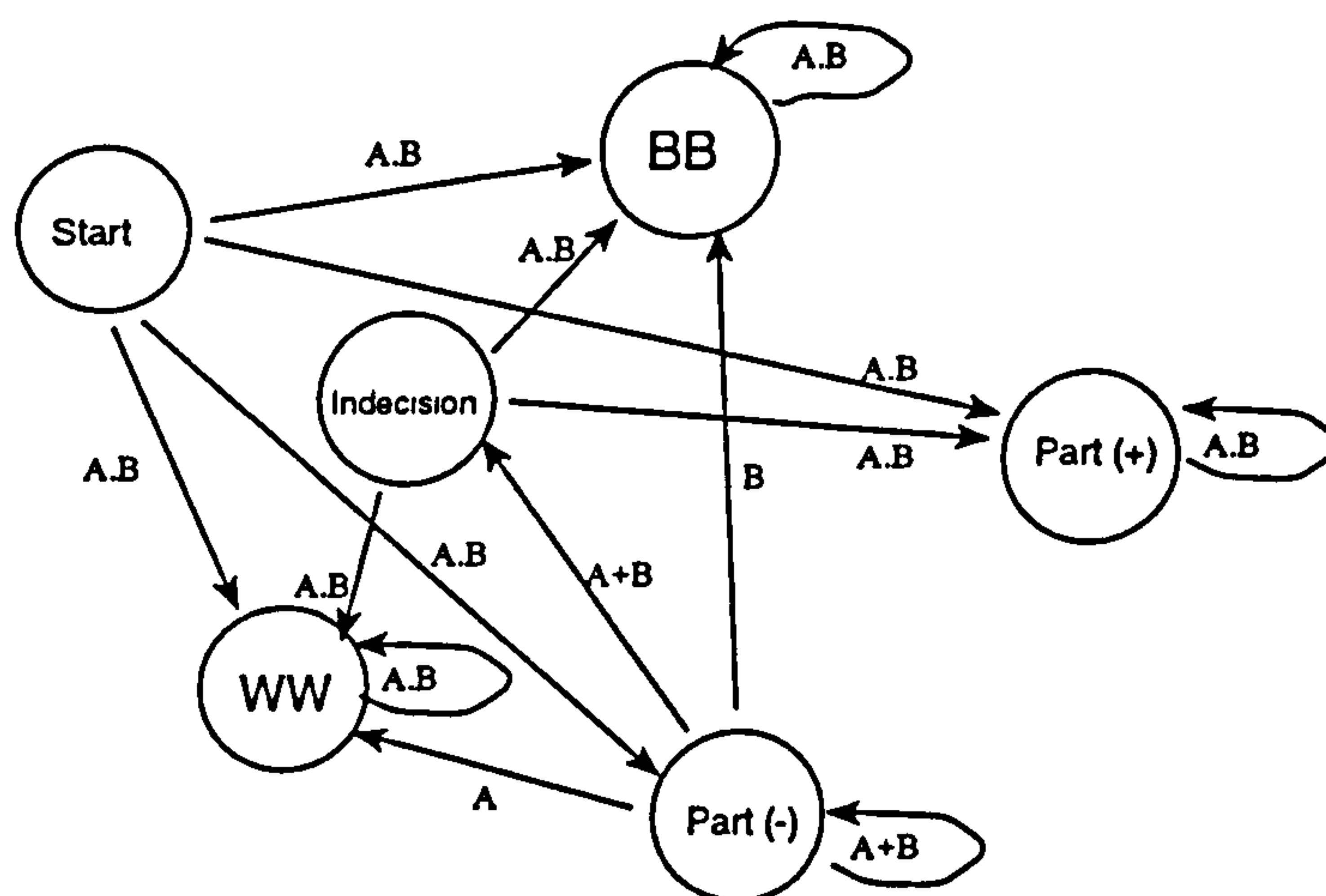


Figure 46: Directed graph for Battle of the Buddies II

Figure 46 represents a game definition wider than that presented in Battle of the Buddies and gives an indication of the kind of expansion to the simple situation which one stage of analysis using Powergraph can produce.

In terms of a behavioural analysis, taking the motivations and powers inherent in the diagram at face value, we can describe the situation as follows:-

- 1) There are three possible stable outcomes, namely both to go to the wrestling, both to go to the ballet or both to go separately to their preferred choice but on good terms.
- 2) Initially an attempt will be made, by virtue of the players' choosing events, of agreement on the wrestling on the part of both players, or on the ballet by both players. If that is the case, the game will end so. Thirdly there is the possibility of a disagreement by both players choosing their preferred options (leading to Part (-)). There is also a possibility that each player will immediately see that there is possibility of agreement by the two to part on good terms (Part) (+)).
- 3) A disagreement is unlikely to be maintained (because of the preference orderings of the two players) and so an adoption of an agreement to attend wrestling or ballet (which will require one of the two to alter in favour of

his friend) will result. Alternatively it may be possible that a state of indecision will be reached from which it may be possible for a third equilibrium to be reached whereby both players agree to part company, but on good terms.

There is, as in the conventional game theory solution and the *Battle of the Buddies* addressed earlier, no basis for deciding on which of the equilibriums will emerge. It is, however clear that the two will not part on bad terms, and therefore the relationship appears safe. The essence of ensuring predictability and determinism in the game is to remove the insolubility produced by the complete symmetry of the solutions by a prior agreement on the order of play at **Part (-)** and at **Start/Indecision**. Just as before we could conceive of the two players agreeing on the toss of a coin that one of them would choose first, or that one of them would choose if there were a disagreement in the first instance.

There is a relaxation of the diagram which we can adopt, additionally, by imbuing the players with a rationality which comprehends Figure 46. They may observe that if they adopt the order of play coin-tossing resolution there is no need for them ever to revert to the fallback of **Part (+)**. They argue thus. If we can agree on either **WW** or **BB** then jointly we prefer that to **Part (+)**, and so we will never adopt any path which leads to **Part (+)** if one of the two others can be an equilibrium solution. Hence we will never choose **Start > Part (+)** or **Indecision > Part (+)**.

Chicken

The game of *Chicken* is of importance in the study of international strategic conflict and has been used extensively as a paradigm for arms races (Sandler and Hartley, 1995; Ordeshook, 1986). It is also of interest in certain business situations, for example, when two companies compete for domination of a market in such a way that withdrawal from the race leaves the other in complete control of the opportunity, the withdrawing company being no longer viable. Like the other two classic games addressed in this section, is of interest not because it offers any plausible, complete, model for business behaviour, but rather because it is a game well (some would say exhaustively) analysed, which presents a simplistic but archetypal model for social behaviour.

The objective of this section, then is to compare the solution provided by classical analysis with the equilibrium statements and results of a Powergraph approach.

In describing the game we can do no better than to quote from Morris (1994, p117).

' ... Two teenage males with cars meet at a lonely stretch of straight road. They position the cars a mile apart, facing each other, and drive toward one another at a high rate of speed. The cars straddle the center (sic) line of the road. If one of the drivers swerves before the other, then the swerver is called 'chicken' and loses the respect of his peers. The nonswerver, on the other hand, gains prestige. If both swerve, neither is considered very brave but neither really loses face. If neither swerves, they both die. We assign numerical values, somewhat arbitrarily, to the various outcomes. Death is valued at -10, being chicken is 0, not swerving when the other driver does is worth 5, swerving at the same time as the other is valued at 3.'

Table 35 shows the appropriate payoff bi-matrix.

		B's choice	
		Swerve	No swerve
A's choice	Swerve	(3,3)	(0,5)
	No swerve	(5,0)	(-10, -10)

Table 36: Payoff bi-matrix for Chicken

Conventional Analysis

As Morris (ibid., p117) observes, viewed as a cooperative game both players should quite clearly swerve, but the conclusion is dependent upon the relative sizes of the pay-offs. If the (3,3) payoff is replaced by (2,2) it is better in game-theoretic terms to toss a coin to decide who should swerve. This conclusion comes from a mixed strategy analysis of the outcomes. If the change indicated is made the total payoff to the players if both swerve becomes 4 rather than 6. The total payoff to the players if only one swerves (by prior agreement) is 5 in both cases. Hence it is better for the two together to accept the greater payoff of tossing the coin to make a prior agreement. The concept of tossing a coin as a means of establishing the pecking order in teenage sub-society may, however, encounter some obstacles before it becomes accepted social practice.

There is a fundamental difficulty here with the concept of numerical pay-offs. As discussed previously, the concept of numerical pay-offs in games is usually defended in terms of dominated utility measures, where the important factor is the relative ordering of players' perspectives on the utility of the various outcomes as opposed to the ordinal measure. If the players were paid here to compete and the monetary return were deemed to be an adequate and complete measure of utility of outcome then we might feel comfortable with the game-theoretic, numerically-based argument that if the pay-offs for (swerve, swerve) were to be changed from (3,3) to (2,2), then the nature of the solution would change. But in practice there is a difficulty over the common knowledge within the game structure of the pay-offs to the players (and indeed the stability of the utility of outcomes as the game

the pay-offs to the players (and indeed the stability of the utility of outcomes as the game progresses). To be precise, we can conceive of a degree of certainty in establishing the relative ordering of outcomes but it would seem unlikely that players could agree even in their own proportional judgements as to the utility of the various outcomes: we may agree that death is preferred to dishonour, but to agree that death has a utility, say, 3 times greater than dishonour appears to present certain difficulties to the player. The game theoretic argument here is in danger of claiming that the tactic adopted by the players is dependent upon a numerical exactitude which cannot in practice exist.

Of course, *Chicken* is not a wholly cooperative game, and other solutions to the tactical problem which do not require cooperation have been presented. One of the most interesting is the transcendence of the game structure by a conscious act of irrationality. Since, without cooperation it is clearly in an individual player's best (rational) interest to swerve rather than die, the meta-tactic is to present a denial of rationality. The proposal is to make a prior rejection of the process of arriving at a rational tactical solution by offering evidence of irrationality. For example, observation that the other party in the *Chicken* game is clearly so drunk that he cannot be responsible for his actions, even to the extent that he is seen to be tying the wheel of the car so that swerving cannot take place, would present a different problem to the other player than the conventional problem. In the 'drunken opponent' case, one has no option but to swerve. It is an interesting example of how, rarely, irrationality, introduced at a level above the strict definition of the game can be a winning tactic.

This is not merely an idle and amusing observation. In many less terminal games, such as Rasmusen's (1989, pp99-106) analysis of nuisance suits, the conclusion is reached that if the nuisance plaintiff makes no prior sunk cost arrangement with his lawyer (so that he has to bear an additional cost if the case actually goes to court), then he will never bring a nuisance suit. Rationality takes over and allows a backward recursion through the nodes of the extended game tree with the conclusion that it will not be worthwhile. Surprisingly, however, if the plaintiff pays his lawyer a flat fee which is paid whether or not the case actually comes to court, it becomes worthwhile to bring the nuisance suit. The parallel

costs, there is a new understanding on the part of the defendant that his irritating opponent puts nothing further at risk in going to court.

States

In the Powergraph analysis of Chicken we adopt the following states which recognise the approach phase of the game as well as the conclusion and the possibility that the cars may miss one another (or alternatively that there is a non-fatal collision) even if neither swerves. In this way we approach the game situation in a more open-ended fashion, aiming not, as the conventional theory does, at a convincing solution for a specific well-defined game, but rather at a model of the game situation which provides a basis for both extensions to the game definition which reflect reality more closely and at a 'solution' which is normative rather than descriptive.

We have three players, Marlon (M), Brett (B) and chance.

Start	The cars are stationary facing one another.
Converge	The cars are moving towards one another
mB	Marlon swerves, Brett holds
Mb	Marlon holds, Brett swerves
mb	Both swerve
Miss	No one swerves - the cars miss one another
Crash	The cars crash

Preference Ordering

Taking into account the game-theoretic payoff matrix, we adopt the following ordering

Taking into account the game-theoretic payoff matrix, we adopt the following ordering

	Marlon	Brett
Start	6	6
Converge	5	5
Mb	1	4
mB	4	1
mb	3	3
Miss	2	2
Crash	7	7

Table 37: The preference ordering for the enhanced Chicken game

Chance, as a player, has no preference ordering, but prefers Miss to Crash with a certain probability, p .

These preference orderings reflect the perception that both players would prefer to survive the game, that there is a certain merit in having not swerved. Additionally, to swerve when the other player has not involves a serious loss of face, but if both players do not swerve and the cars miss one another by chance the result is better than both having swerved.

Feasibility Matrix

Table 38 shows the feasibility of transitions for the enhanced Chicken game.

	Start	Converge	mB	Mb	mb	Crash	Miss
Start	MB	M+B	-	-	-	-	-
Converge	-	MB	M	B	M.B	M.B.C	M.B.C
mB	-	-	-	-	B	-	-
Mb	-	-	-	-	M	-	-
mb	-	-	-	-	-	-	-
Crash	-	-	-	-	-	-	-
Miss	-	-	-	-	-	-	-

Table 38: Feasibility matrix for enhanced Chicken game

Note that most of the entries are empty, reflecting the assumption that adoption of a swerve is irrevocable. Twitching the wheel is not allowed, but could easily be the topic of a signalling game which allows intent to be indicated during the converge phase.

Motivated Power Matrix

Table 39 below shows the effect of introducing the preference ordering and Figure 47 represents the motivated power matrix in graphical form.

Motivated Power Matrix for enhanced Chicken							
	Start	Converge	mB	Mb	mb	Crash	Miss
Start	-	M+B	-	-	-	-	-
Converge	-	M.B	M	B	M.B	-	-
mB	-	-	-	-	-	-	-
Mb	-	-	-	-	-	-	-
mb	-	-	-	-	-	-	-
Crash	-	-	-	-	-	-	-
Miss	-	-	-	-	-	-	-

Table 39: Motivated power matrix for enhanced Chicken game

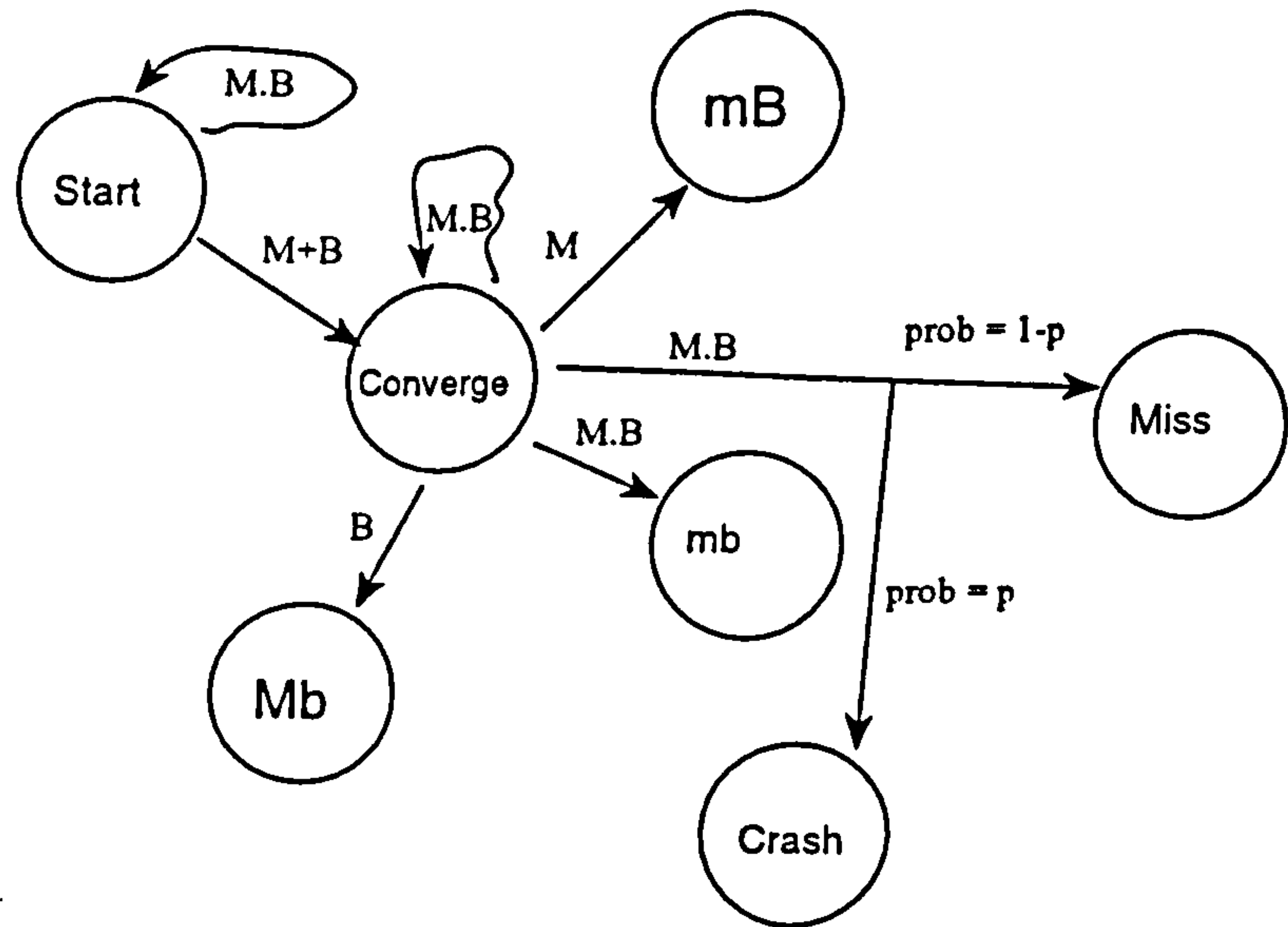


Figure 47: Motivated power network for enhanced Chicken game

Observe here that the structural characteristics of the Powergraph model are identical with that of the conventional game theoretic solution. In particular both treatments agree that Crash is avoided by the players if the probability of crash given convergence is 1 (since the path Converge > Crash dominated by M.B will be unmotivated if Crash is inevitable). The dilemma of the players at state Converge is illustrated clearly in the Powergraph

network. Player M, for example is in control of the transition **Converge > mB** and will be forced to take it (we have set the preference ordering for **Converge** to be less desirable than any outcome; the players cannot converge for ever). Similarly B must make a decision at some point and the diagram indicates a transition to **Mb**, paralleling the conventional presentation. The boolean expression **M.B** on the transition **Converge > mb** (indicating that both have chickened out) requires the cooperation of both parties. The preselection issues raised by Morris (op. cit.) are exemplified by the order of play dilemma from the state **Converge**. The rational player will observe that from **Converge** the other player may be in control and that this can only be made deterministic if a predetermination is made as to what happens at converge. This is identical to the argument used in conventional game theory.

The 'winning by irrationality' argument appears from the diagram also. If from **Converge**, M, for example, is bound to reject the path to **mB** leaving the probabilistic path to **Crash/Miss** (See also below), B will be forced to take path **Converge > Mb** in order to avoid a loss of utility.

The probabilistic path **Crash/Miss** presents no real escape route for the players unless the probability of **Crash** rather than **Miss** occurring is very small. Theoretically we could use an expectation argument to determine whether for both players the expectation of utility gained from **Miss** (at probability $1-p$) is greater than the utility (at probability p) gained (?) from reaching **Crash**.

In summary, the nature of the solutions proposed by Morris (ibid.) and others of the Chicken game also emerges from the Powergraph approach. Additionally, the Powergraph network can be seen to present a basis for discussion of the wider game environment. For example, what does the sustainment power expression **M.B** mean in connection with the **Start** state? Can we think of methods of ensuring that both M and B in that state are unwilling to proceed to convergence? What, for example, is making them judge the **Converge** state to be better than then the **Start** state. Perhaps the presence of bystanders is altering their rank ordering of preferences. Perhaps the feasibility of proceeding from **Start > Converge** can

be removed by disabling the cars. All these and similar contextual, meta-game issues fall outside the definition of the game as described by conventional game theory, and there is no implication of failure on the part of conventional analyses as a result, but the Powergraph approach can be seen, potentially, to provide a framework of examination for such games as *Chicken* which render it more useful than the conventional treatment, while encompassing all the results which they produce.

Chapter 8: State Generation

Problem statement

One of the key steps of the Powergraph method for resolving conflict situations is the generation of a set of states which, in some sense satisfactory to the client actor, represents the future development possibilities of the situation.

We have seen elsewhere that the Fraser and Hipel method generates the futures states of the conflict by consideration only of the tactical choices open to the participants. The states are defined, in fact, entirely by the set of selections made by the players. This generates a rich set of states which can result from those tactical choices being made. These combinations of choices are then examined for feasibility by a method not dissimilar to that of EFAR, and frequently as few as 20 or 30 states result (Fraser and Hipel, 1984, p88, p94, p40). In applications other than the pedagogic ones detailed in Fraser and Hipel (1984), however, the resulting set of outcome states can be rather large. This of itself is not a great problem when using the Fraser and Hipel algorithms, because of the limited nature of their motivation-power logic. Because of the concept of a UI (unilateral improvement) in the Fraser and Hipel method the motivated transition matrix can be generated by a simple algorithm. However, when the concept of motivation-power comprehends more than one actor (i.e. the transition is controlled no longer by a single participant, but by, potentially, more than one) the generation of the transition matrix becomes distinctly more onerous.

Moreover, the Fraser and Hipel approach requires only a simple algorithm, the output of an automatic function of the tactical choices made by the participants (which define the source and end states) and their preference ordering. In the Powergraph algorithm, however, the examination of the respective powers of the participants in a particular transition is in part a judgemental matter, and, while it is clearly assisted by an algorithm, cannot be done purely on a procedural basis without losing significant opportunity for the inputting of experientially-based knowledge into the model of the conflict.

In Chapter 3, the wisdom of limiting the state generation process to states derived from the tactical choices of the participants alone has been questioned. The essence of the difficulty is that if the future is seen exclusively as a result of *a priori* tactical choices, the opportunity to generate new tactical choices is limited. The preferred method advocated here is that the future of the conflict should be seen as deriving not merely from the tactical choices made by the participants, but also from other, exogenous or non-tactical, variables. Thus, for example, the state of acceptance of a participant is a valid basis for characterising the state of affairs (a non-tactical variable, since it cannot be chosen as such) as can the actions of an actor not explicitly included as a participant or the 'actions' of chance (both exogenous factors). If the tactical choices are the entire basis for the future states of nature, no new tactical choices can emerge from their consideration; rather, what emerges are new states of nature which were not conceived of. If, conversely, the possible outcomes are generated directly, no constraint is placed on the generation of new tactical options, and these may well emerge from the consideration of what is necessary to reach the desired states and prevent movement to or towards the less desired states.

This, naturally, can complicate the issue further, and the exhaustive Fraser and Hipel style of state generation becomes less appropriate as the number of state variables (whose values collectively define the state of nature) becomes greater. We see in the example of *The Postage Stamp Crisis* of 1937 (a relatively simple international conflict described below), that the conventional method leaves much to be desired in terms of providing a set of future (outcome) states which at the same time characterise the future adequately, while providing a simple, tractable solution framework for the Powergraph method.

The problem, then is to indicate a procedure for generating a sufficiently rich set of outcome states while retaining coherence and structural simplicity in order to allow the maximum input from the domain expert into the conflict model.

Subjective worlds and the belief-space problem

There is a particular difficulty associated with the generation of outcome states based upon any attempt to 'put oneself in the shoes' of other participants. It is known as the subjective world problem, and is most easily expressed using the terminology of Schutz and Luckman (1963) as used by the German post-Marxist philosopher, Habermas.

Habermas (1981, 1986, vol. 2, chapter VI) utilises the concept originated by Schutz (1962), primarily, that underlying all possible knowledge lies a *lifeworld*, the body of all knowledge which could be known by persons attempting to act within the *system*, the set of all physical realities in which the acts of life are carried out. Each participant thus samples the lifeworld to produce his own subset, known as the subjective world (SW). This subjective world is not merely the subset of all things which could be known in a physical sense, but includes the process and objective values, moral judgements and all other things supposed to be known by the participant. Consequently all persons will have different subjective worlds by virtue of their different standpoints. This is often summarised by the relativist mantra that 'we all see different rainbows'.

Habermas goes on (ibid.) to develop extensively the concept of communicative rationality, whereby an act of any type has reality or rationality only to the extent that it is expressed in a valid context to other participants in the system, the word 'system' here being used in a specific sense; firstly as a foil to the concept of the lifeworld in order to contrast the physicality and abstraction of the latter with the physicality and procedures of the former and secondly to give an intimation of association with the social system in which Marx and post-Marxists mobilise their philosophies. Thus knowledge becomes defined by the extent to which a position or assertion is understood and comprehended (but not necessarily agreed) by other participants.

In the limited objectives of this note we are concerned primarily with a subset of the SW of a player which, in a way similar to that of Bacharach (in Binmore, 1993, pp255-276) we define as those things deemed by a player (and therefore thought to be known by him)

which are relevant to the struggle in question. We shall call this the belief-space of the player, and as it is a sample of the subjective world, we shall represent the belief space of player i by the expression SW_i .

Figure 48 illustrates the subjective world problem. Consider two players A and B engaged in a struggle. Each will have a different belief space, SW_A and SW_B and they will overlap to some extent as shown. From the point of view of player A, he knows that B will have at least some part of his belief space which A does not know and that A does not know what that is. A, however, knows what he knows and what he judges to be relevant to the struggle, and can conceive of what he knows about B's belief space. This latter is the intersection of SW_A and SW_B as shown.

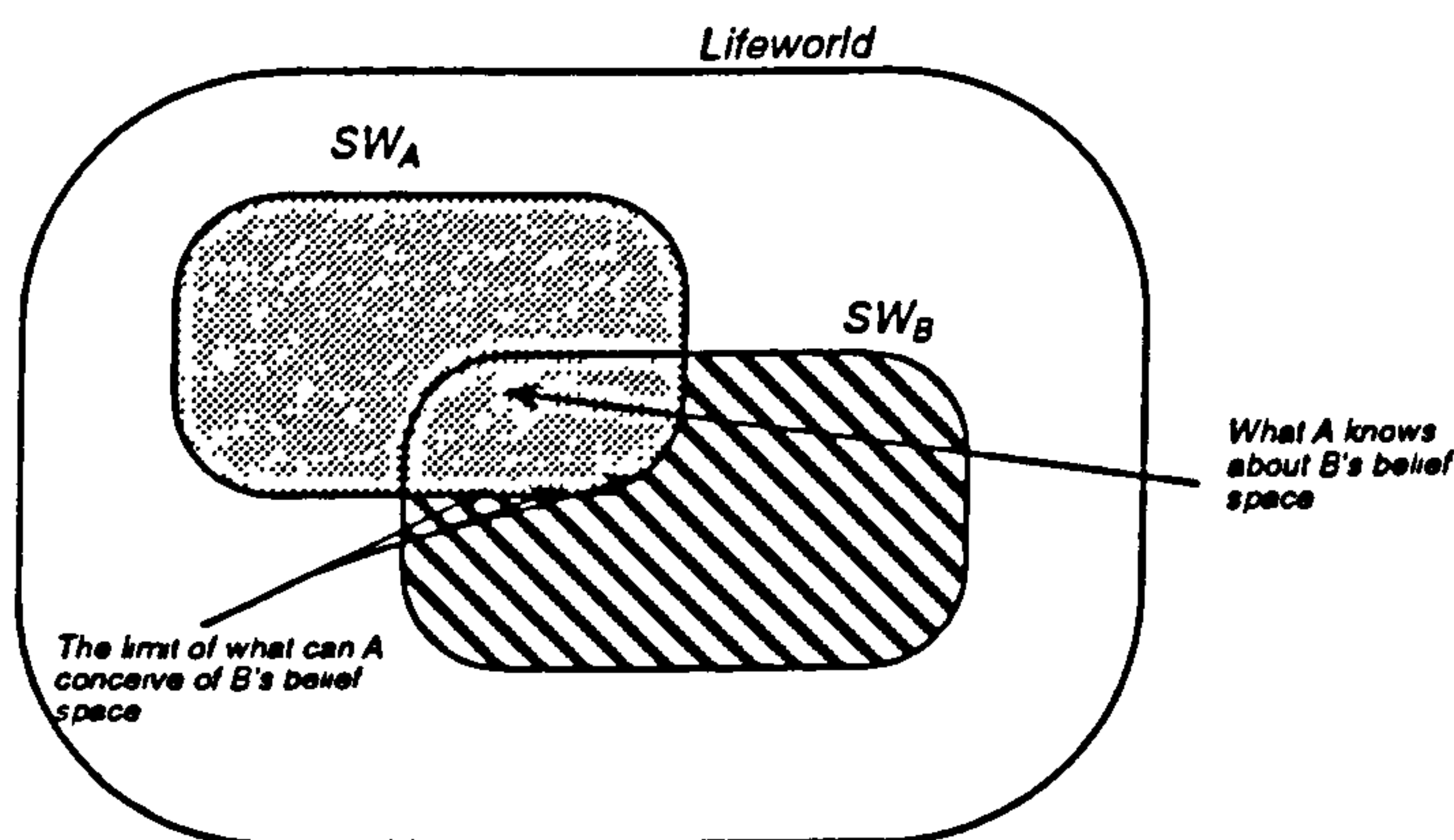


Figure 48: Limitations of knowledge and conception

A's problem, of course, is that while he possesses this latter knowledge, and knows the extent of what he knows about B's belief space, he does not know how far B's belief space extends. Thus he cannot know what he cannot conceive of about B's position. Any attempt to hypothesise about B's position is limited to those things which A can conceive of in B's position, and these things are limited to the immediate vicinity of what A knows about B's SW. Thus, attempts to enlarge upon the knowledge which A possesses of B's position is limited to the boundary of A's knowledge about B.

Put simply, the philosophical position is that A cannot enquire about something in B's subjective world of which A has no conception. This presents some insurmountable

difficulties in the extrapolation of A's belief space to encompass what B's belief space is in order that B's behaviour can be predicted.

The only hope is to develop the boundary of SW_A , and in the procedure outlined below, the purpose of the initial stages is to provide some structure for this extension process.

Possible approaches to the state generation problem.

There are four main approaches to the generation of states appropriate for the use of a Powergraph representation of conflict:-

a) Intuitive

Here the informant is asked to simply write down what states are, in his opinion likely to prevail in the timescale of evolution of the conflict.

In simple cases this is an appropriate approach, the client simply casts his or her mind forward and tries, without any great attempt at analysis or structure, to predict the evolution of the conflict in question. In the applications reported in Chapter 8, and in other cases, this approach was satisfactory to a degree, but exhibited some shortcomings. First, it is necessary that the client should be fully aware of and immersed in the problem. If this is the case, a degree of cognitive rehearsal has already taken place, and there is a good prognosis for the development of the states.

Second, the conflict has to be seen initially as simple in its development. Often the informant becomes simply overwhelmed by the potential futures, particularly if the first informal representation is that of a highly unstable situation with a number of participants, each of which can push the conflict in different directions.

Third, and most important, is the difficulty that the intuitive method does not admit partial use of a structure. A number of attempts were made, during this research, for example, to model the situation surrounding the Italian elections of 1996, with no success. The process of failure was as follows. The informant, an Italian researcher fully aware of the detailed

dynamics of this complex subject, first attempted to cast his mind forward and made good progress by prediction of the processes and dynamics of the changing political situation. Then, in an attempt to implant a *de facto* structure the options of the participants were detailed, and immediately the intuitively derived summary structure was thrown away, using the argument that '*the states deriving from the tactical choices are so much easier to order. You can check whether you have missed any*'. Lastly the problem was discarded as too difficult because the tactical choice approach threw up a level of detail too great for the client to hold in the mind.

Conversely, a good example of the intuitive approach working in practice is that of *The Spanish Mayor* (Chapter 9), where, again, a client totally immersed in the problem and with the benefit of hindsight, found it relatively easy to summarise the futures for a blackmail situation. This is not an entirely false example, since although the client had perfect knowledge of what actually happened, the Powergraph state generation problem is to determine a plausible set of states for what may have happened. The client found this relatively easy to do because of the similarity of the situation to many others with which he had previously dealt, and because he had an intimate knowledge of the likely mechanisms involved.

The conclusion, then, from the evidence of practice, is that the intuitive method is appropriate if

- the client has substantial immersion in the problem

- significant cognitive rehearsal has already taken place

- the problem is seen as simple at the start of the process

- the client can be restrained from applying an exhaustive procedural approach.

In practice this last task is not easy to do. It is similar to the Zen teacher asking his student to meditate for an hour without thinking about white tigers.

b) *Incremental and resolving approaches*

One possible method is that of concentrating on elements of an existing network and generating new states on the boundary of the network (incremental growth) or breaking existing states down into more detailed state definitions. This can be effective, and is, in fact a good way of applying some procedural discipline into the intuitive approach without paying the cost of the combinatorial despair caused by the application of an exhaustive method.

One can observe clients using this approach intuitively, but at this stage no work has been carried out to determine whether this is a viable general method for building up networks. Some observations, however can be made as to the general wisdom of such an approach on the basis of the experiences summarised in *The Battle for Trafalgar* case study and the *Mardonius and the Greeks* case study reported above.

Without a justifying superstructure of values or tactics it provides no better a basis for proceeding than the arbitrary one of intuitive state generation

At worst it can simply generate a mass of detailed states unsupported by any stopping rule. No judgement is being applied as to whether the discrimination between states is significant or not.

At best, like the intuitive method it produces a network which is of arbitrary size. There is no externally applied rule indicating whether it is in any sense complete or sufficient (or not).

c) *Bottom-up method*

The method used by Howard (1971) and Fraser and Hipel (op. cit.) is essentially an exhaustive descriptive method which leads to a complete list of outcomes defined on the basis of the tactical choices made by the participants. The method assumes that it is the tactical choices of the participants alone which determine the future, and under certain assumptions this is true. To be more precise, we must consider that the model is complete

in the sense that all participants who have any control over the development of the situation are included in the tactical definition. Additionally we must assume that the 'state' of the participants is defined adequately by their tactical choices alone. Thirdly, we have to assume that the knowledge we possess of the tactical choices is adequate, i.e. the representation is sufficient.

With these assumptions we can then define the tactical choices of the participants as a series of bi-valued decisions. The case study *The Postage Crisis*, described fully later in this chapter provides a suitable example. In this conflict the choices available to the participants are shown in Table 40.

Postage Stamp Crisis											
Bottom-up Generation											
Nicaragua	claim territory	0	0	1	1	1	1	1	1		
	move troops fwd	0	0	0	0	1	1	1	1		
	invade H	0	0	0	0	0	0	1	1		
	enter negotiation	0	1	0	1	0	1	0	1		
	accept negotiation	0	1	0	0	0	0	0	0		
Honduras	move troops fwd							0	0	1	1
	invade N							0	0	0	1
	enter negotiation							0	1	0	1
	accept negotiation							0	1	0	0

Table 40: Tactical choices in the Postage Stamp Crisis

Here we see that the two participants, Nicaragua and Honduras have a series of choices to make, ranging from the declaration of an interest in a piece of territory to invasion. Table 40 above shows that certain choices can be made together. We see, for example, that Nicaragua can both claim territory and enter negotiation. Certain actions (tactical choices) must be made together. For example, in Table 40, in order for Nicaragua to accept negotiation, she must have entered negotiations. This is reflected in the appearance of a 1 in both the relevant rows of Table 40.

Next, (and again, described more fully later in this chapter) the mutual compatibility of the two players' joint choices is checked. Thus, in the example of Table 40, any combination

of tactical choices of the two players together which has one participant entering negotiations while the other does not cannot be admissible; the definition of '*enter negotiation*' is that of a joint negotiation. This and similar arguments lead to extended list of combinations of tactical choices made by the two participants which are mutually compatible.

In principle, one can extend the procedure beyond that of Fraser and Hipel to cluster states together, so that, for example, if it is judged that the state of the battlefield is not important if a negotiation is taking place, one would group together all states (tactical choice combinations) which have *enter negotiation* = 1 for both players. This group of states would then be renamed appropriately.

Thus one can conceive of a process for state generation which takes the exhaustive Fraser and Hipel procedure and groups states according to some *ex post* criterion or criteria of indistinguishability.

There are practical difficulties with this procedure, which nevertheless remains potentially a method for state generation. First, the process does tend to generate excessive number of states. In this respect it is not dissimilar to that of FAR. With FAR the process of state generation throws up many hundreds of states (typically) after the filtering process (Rhyne, 1981; Coyle, Crawshay and Sutton, 1994; Powell and Coyle, 1997; Powell, 1997), and the clustering of the resultant states into groups which bear a closer relationship to what the participants see as reality can take a number of days. While this may be acceptable in the context of a futures study, in the relatively fast moving environment of strategic conflict resolution (where the action horizon is often measured in days rather than in years) this is unacceptable.

Second, the process is essentially weakened by its initial reliance on the tactical choices as the basis for the future. As argued elsewhere, this initial reliance can lead to a cognitive limitation. If the tactical choices define the future, the tactical choices chosen initially tend to be the only ones admitted. If, on the other hand the futures are subsequently used to define the tactics in the form of an action plan, new and previously unseen tactical choices

may well emerge.

Third, because the discriminants for clustering are applied *post facto*, there is an essential inefficiency. With a number of participants, many hundreds of states result when the participants actually value and discriminate among only a score or so. This is most wasteful of effort.

Last, one observes that if clustering is carried out with a large number of states the resultant state network structure can be expected to be more complicated than one derived from the same problem approached top-down. This is because the discriminants applied to states are not clear cut. They are the basis of experiential rules heuristically applied. As a result, if a synthetic procedure (bottom-up) is applied, in cases of doubt two states will not be combined, whereas if the procedure is essentially analytic where states are decomposed, a state will not be broke into two or more unless the discriminant can be applied with obvious reason. The result is that the bottom-up method essentially produces more complex networks for later solution.

d) Top-down valued based method

The fourth approach considered was the analytic approach or top-down method by which a small number of states are defined on the basis of what the participants perceive or value within the situation and these states are then decomposed if necessary to give a more detailed state description of the conflict. This is shown in practice in *The Postage Stamp Crisis* case of this chapter of this report, and a detailed description of that particular example will not be repeated here.

The process in general is essentially simple.

- 1) The domain expert or client is requested to indicate a small number of discriminants which each player would apply to the results of the conflict. This is conveniently done by a semi-structured discussion about the aims and objectives of the different participants concentrating on what the main criteria

for success (of various kinds) or failure could be. There appears to be a natural synoptic process which takes place where the more complex the situation (say the War of the Austrian Succession) the more the skilled expert summarises. Because the focus of the semi-structure is on the objective the detail of implementation is left undeclared, a phenomenon which is most inconvenient for the bottom-up approach but one which fits in most conveniently with the Powergraph concept of allowing action planning to emerge from examination of the behaviour of the conflict rather than *vice versa*.

2) According to the discriminants a small state space is set up which offers a base state for each of the values which each discriminant can take. This is done for each player separately. Three examples can be found in Tables 41, 42 and 43 below for Nicaragua (*N*), Honduras (*H*) and the international community (*I*) respectively.

3) If appropriate each of these states is allowed to be decomposed into a small number of substates, where the original discriminants are incomplete. This incompleteness can arise essentially from two sources. First, there may exist obvious states which need to be recognised as discriminated by the participant in question, but which do not fit easily into the discriminant structure. Second, pre-defined states may exist (Start, for example) which the modeller can predict will need to be accounted for in the state space.

4) By a filtering method of pairwise comparison of compatibility of the base states of each player, a set of states defined by the total set of discriminants for all the players can be generated. In effect this results in a correlation of the base states for each player with that of each other player. The combination of these states then constitutes a first level state space on which basis a network can be constructed.

What is happening in this process is essentially very simple. The discriminants for each

player constitute the minimal value system on which basis the outcomes are judged. On the basis of the values placed on the outcomes outcome states are valued as better or worse than other states. Conversely, if a participant does not place any value on the difference between two states, then those states will not be discriminated, and will be seen as indistinguishable by that player. By examining the basis on which outcomes are valued, then, we have a basis for determining what the player will perceive, since valuation and perception are strongly related (Treisman, 1960; Uhr, 1966; Neisser, 1967).

The base states for each player constitute a subjective world for each player judged according to the implicit discriminants. The base state spaces for each player are combined to produce a higher dimensioned state space whose dimensions are the discriminants of each player. Each base state space can be considered mathematically as a space the dimensions of which are the discriminants the actors. The allowable values along those dimensions are defined by the values admissible for the discriminants.

The filtering method then provides a series of mappings which identify states in one subspace of the multidimensional space with states in another. Put in vector algebra terms, each player's base state space is a null space of the combined space whose base is the union of the discriminants of all the players.

An example — The Postage Stamp Crisis

Background and description of the Crisis

The Crisis originated in a judgement by the Spanish sovereign in 1906 regarding disputed land between Nicaragua and Honduras. The Spanish sovereign ruled in Honduras' favour, but Nicaragua never accepted the ruling. The summary below is taken verbatim from Brecher et al. (1988, p161).

'During the second week of August 1937 Nicaragua issued a postage stamp bearing a map of the Republic which included a considerable part of southeastern Honduras, marked as being 'territory in dispute.' This triggered a crisis for Honduras, which protested this

'affront to her sovereignty' on the 25th. On 30th August Honduras' major response was concentration of military forces along the border. The possibility of military hostilities triggered a crisis for Nicaragua. Its response, on 3 September, was a refusal to withdraw the stamp, declaring it to be the official map of Nicaragua.

Armed hostilities were prevented by the mediation of Costa Rica, Venezuela and the United States. On 10 September 1937 the two crisis actors signed a Pact of Reciprocal Agreement at San Jose in Costa Rica, terminating the crisis. The conflict flared up again in 1957... .'

The conflict is one of the simplest in Brecher's (op. cit.) directory of twentieth century conflicts. Nicaragua makes a claim, Honduras packs the border and a standoff results which is eventually resolved by a mutual agreement brokered by the international community which at least temporarily resolves the conflict.

In point of fact the conflict could have resulted in various types of escalation. Nicaragua could have invaded; Honduras could have attacked Nicaragua. The outcomes also could have been different; Nicaragua could have negotiated a territorial gain; a stalemate could have resulted.

The analysis below indicates some of the reasons why the conflict followed the trajectory which it did.

The Actors

There are three actors

N Nicaragua

H Honduras

I the international community

Nicaragua is motivated primarily by the territorial aspects, an issue dating back to 1906. In particular she has as main priorities the public laying of a claim to land which she considers

is national territory, and the gaining of that territory. Clearly, by examination of her offensive actions she is, at least at this initial stage of the conflict less concerned about the potential outbreak of war. Equally she clearly discriminates between having gained territory and having an unresolved claim. The latter is clearly different from having won or lost the territory in any final sense, either by virtue of a negotiation or by virtue of a military standoff.

Honduras, on the other hand is concerned not only with not losing territory but also with the threat which Nicaragua presents, and discriminates the scene (as far as we can judge) on the basis of whether she is threatened actively or not and whether she remains territorially intact. Sub-discriminants of these are represented by the distinction between there being a stalemate as opposed to her being under attack, and by whether there is a settlement in place or not, but these are viewed as being subsidiary to the former two main discriminants.

The international community has a rather different agenda and is concerned primarily with the state of stability in the region (open conflict, a state of tension or relatively peaceful 'concordance of nations'), and whether threatening behaviour on the part of any state has led or is likely to lead to a cession of territory. The former is easy to reconcile with common sense, as is the second when the observation is made that in general terms the international community will always act so as to discourage any changing of the status quo, since a more stable situation threatens the position of individual national leaders less than a world in which an aggressive power can upset the local balance of power and make material gains by armed action or the threat of the same (Mitchell, 1981).

State generation

The state generation method followed here is the value-based top-down method, where the key issues of the players are stated (for the client actor) and hypothesised (for the remainder)

The base states of the three actors are as shown in Tables 41 to 43 below.

Postage Stamp Crisis - Value-based State Generation			
Nicaraguan Perspective			
Claim Made			
		C	C
Territory Gain	T	1) N gains territory	
	To	1) N issues claim but no resolution is made	1) Start position
	T	1) N's aims are blocked by H	1) N fails to gain land and is forced to withdraw her claim

Table 41: Nicaraguan base discriminants.

T = territory has been gained by N

To = no resolution of territorial issues

T̄ = N fails to gain territory

C = claim has been made in the international arena

C̄ = no claim in play

Postage Stamp Crisis - Value-based State Generation			
Honduran Perspective			
Honduras loses territory			
		t	t̄
Under threat	a	1) Under attack and lost territory	1) N issues claim but situation unresolved 2) under attack but holding
	ā	1) Failure: lost territory irrevocably	1) Status quo 2) Withdrawn threat (no negotiation) 3) Negotiated settlement

Table 42: Honduran base discriminants

a = being attacked (under threat)

ā = not under threat

t = Honduras loses territory

t̄ = no Honduran territory lost

Postage Stamp Crisis - Value-based State Generation				
International Community Perspective				
Degree of conflict				
		S	So	S
Territory ceded?	c	1) Negotiated settlement, but borders have changed	1) Face-off after loss of territory	1) Invasion with open conflict
	c	1) Negotiated settlement; no border changes	1) Face -off 2) Start	1) Open conflict unresolved

Table 43: International community's base discriminants

S = settlement by negotiation or stable military situation

So = semi-stable -face-off

S̄ = conflict

c = territory ceded

c̄ = no territory ceded

It will be seen that the base discriminants lead to relatively small initial state spaces. Within these base spaces certain states emerge naturally as sub-states. For example in the international community's base space of Table 43 above, the start position and the face-off where the two sides are not in conflict, but where no settlement has been reached, are seen as different (or are hypothesised by the client actor as being seen as different by the other actor or actors)

Next are identified those states which, from the point of view of each player, are mutually feasible. This includes the cases where a state called status quo by one player is identical with one called start by another. Some states in one player's base space are consistent with certain states in another player's base space.

First we compare the compatibility of *N*'s states with *H*'s states. See table 44.

Postage Stamp Crisis - Value-based State Generation								
Combination of states N and H								
		Under attack and lost territory	Failure: lost territory irrevocably	N issues claim: situation unresolved	Under attack but holding	Status Quo	Withdrawn threat (no negotiation)	Negotiated settlement
N's description		at	at	at1	at2	at1	at2	at3
N gains territory	Tc	Y	Y	x	x	x	x	x
N issues claim but no resolution is made	To	x	x	Y	x	x	x	x
N's aims are blocked by H	Ic	x	x	x	Y	x	x	x
Start	Tog	x	x	x	x	Y	x	x
N fails to gain land and is forced to withdraw claim	Ic	x	x	x	x	x	Y	Y

Table 44: Joint compatibility of *N*'s states and *H*'s states.
Where the table shows X the two states are incompatible; where Y is shown the two states are compatible.

Thus we see that whereas *N* may view states Tc/at and Tc/at as indistinguishable (according only to his initial base discriminants) *H* will view them as different. Nicaragua does not care directly whether Honduras feels threatened by Nicaragua's action; it is not a primary concern of hers.

Table 44 can then be unpacked to provide a list of states (now defined by both *N* and *H*) which are mutually compatible. These states are then examined in the same fashion against the very different base states of *I* in table 45 below. Table 45 has entries which are marked

Postage Stamp Crisis - Value-based State Generation									
Combination of states all parties									
N's description	H's description	Negotiated settlement, but borders have changed	Negotiated settlement: no border change	Face-off: borders changed	Face-off: no borders changed	Start	Invasion with open conflict	Open conflict: no fixed gains	
		cS	cS	cSo	cSo1	cSo2	cS	cS	
N gains territory	Tc	x	x	Y	x	x	Y	x	
		Y	x	x	x	x	x	x	
N issues claim but no resolution is made	To	x	x	x	Y	x	x	x	
N's aims are blocked by H	Ic	x	x	x	Y	x	x	Y	
		x	x	x	x	Y	x	x	
N fails to gain land and is forced to withdraw claim	Ic	x	x	x	Y	x	x	x	
		x	Y	x	x	x	x	x	

Table 45, showing those states defined by all three players which are mutually compatible.

according to whether the states of Table 44 are compatible with the states of I 's base space, Table 43. The marking convention is similar to that of Table 43.

The names of the base states of Tables 41 to 43, in combination here, lend themselves to a naming convention. Each state of Table 44 can be named by stating the shorthand description which each of the players would call it (by referring to Tables 41 to 43). Thus the state which N sees as Tc and H sees as at , while I views it as cSo , will be denoted by $Tc/at/cSo$.

Unpacking Table 45 gives a tree of states, defined differently by the three players according to their base discriminants, which is shown in Table 46. This table illustrates well the different points of view of the three different players. Note that because N is concerned with the gaining or otherwise of territory, state 1 (in Table 46) which has the key $Tc/at/cSo1$ is seen by N as the same as state 3, having a key $Tc/at/cSo$. Similarly player I sees state 4 ($To/at1/cSo$) as the same as state 5 ($Tc/at2/cSo$) since I 's discriminant (the component $/cSo$) is unchanged, whereas the other two players view them as different, and for different reasons by virtue of their different base discriminants.

Postage Stamp Crisis - Value-based State Generation						
Combination of states all parties						
N's description		H's description		Int'l description		Index
N gains territory	Tc	Under attack and lost territory	at	cSo	Face-off: borders changed	1
				cS	Invasion with open conflict	2
		Failure: lost territory irrevocably	at	cS	Negotiated settlement, but borders have changed	3
N issues claim but no resolution is made	To	N issues claim: situation unresolved	at1	cSo1	Face-off: no border change	4
N's aims are blocked by H	Ic	Withdrawn threat (no negotiation)	at2	cSo1	Face-off: no border change	5
				cS	Open conflict: no fixed gains	6
Start	To	Status Quo	at1	cSo2	Start	7
N fails to gain land and is forced to withdraw claim	Ic	Withdrawn threat (no negotiation)	at2	cSo1	Face-off: no border change	8
		Negotiated settlement	at3	cS	Negotiated settlement: no border change	9

Table 46: States compatible with all three players' base states

There results, then, a set of states, differently defined by the three players which together constitute *N*'s best view of the union of the belief spaces of all three players.

Transition power matrix

In the normal way we derive the transition power matrix, filling the cells on the basis of our understanding of the powers available to the participants. Of course, without detailed knowledge of the military strengths and wills of the two main actors, these judgements will be subjective, but it will be seen by examination that they are not unreasonable and, eventually lead to a plausible description of the conflict.

The transition power matrix is shown as Table 47.

Postage Stamp Crisis

Transition Matrix

	1	2	3	4	5	6	7	8	9
	Tc/at/cSo	Tc/at/cS	Tc/a/cS	To/at1/cSo1	Tc/at2/cSo1	Tc/at2/cS	Toe/at1/cSo2	Tc/at2/cSo1	Tc/at3/cS
1	-	H.N	I.H.N	-	-	H	-	-	-
2	H.N	-	I.N.H	-	N	H+N	-	-	-
3	-	-	-	-	-	-	-	-	-
4	-	-	-	-	H.N	-	N	-	I.N
5	-	-	I.N.H	-	-	H+N	-	-	I.H.N
6	-	N	-	-	H.N	-	-	H	I.H.N
7	-	-	-	N	-	-	-	-	-
8	-	-	-	-	-	-	N	-	-
9	-	-	-	-	-	-	N	-	-

Table 47: Feasibility matrix for Postage Stamp Crisis

Preference Ordering

Table 48 below shows the preference ordering of each player for the states 1 to 9.

Postage Stamp Crisis			
Preference Vectors			
State	N	H	I
1	2	7	6
2	3	8	7
3	1	9	2
4	6	5	4
5	4	4	4
6	5	6	5
7	7	2	3
8	8	3	4
9	9	1	1

Table 48: Preference ordering for players in Postage Stamp Crisis

Examination of the table and comparison with Tables 41 to 43 will show that the preferences are consistent with the base discriminants for each player. In other words, the preference shown for states by any player will group states 1 to 9 according to the discriminants of Tables 41 to 43 for that player. Preferences are first exhibited between base states and only then within base states. Thus player *N* sees states 1,2 and 3 as sub-states of his base state *Tc*, and so we see the preference ordering of these states as adjacent. If we were to see in Table 48 that *N* saw state 5 as having preference 3, we should know that the base discriminants were incorrect, and we should have to return to the beginning of the process in order to incorporate the newly understood base discriminants of *N*.

Motivated power matrix

By the usual method of comparing the preference orders of start and end-states together with the contents of Table 47, we derive Table 49, which shows which transitions are both within the power of participants to bring about and, at the same time are desired by them.

Postage Stamp Crisis									
Transition Matrix									
	1	2	3	4	5	6	7	8	9
	Tc/at/cSo	Tc/at/cS	Tc/at/cS	To/at1/cSo1	Tc/at2/cSo1	Tc/at2/cS	Toe/at1/cSo2	Tc/at2/cSo1	Tc/at3/cS
1	-	-	-	-	-	H	-	-	-
2	H.N	-	-	-	-	H	-	-	-
3	-	-	-	-	-	-	-	-	-
4	-	-	-	-	H.N	-	-	-	-
5	-	-	-	-	-	-	-	-	-
6	-	N	-	-	H.N	-	-	H	-
7	-	-	-	N	-	-	-	-	-
8	-	-	-	-	-	-	N	-	-
9	-	-	-	-	-	-	N	-	-

Table 49: Motivated transitions for the Postage Stamp Crisis

Directed Graph

Figure 49 below shows the graphical version of Table 49. The states have been renamed to be more accessible to the reader.

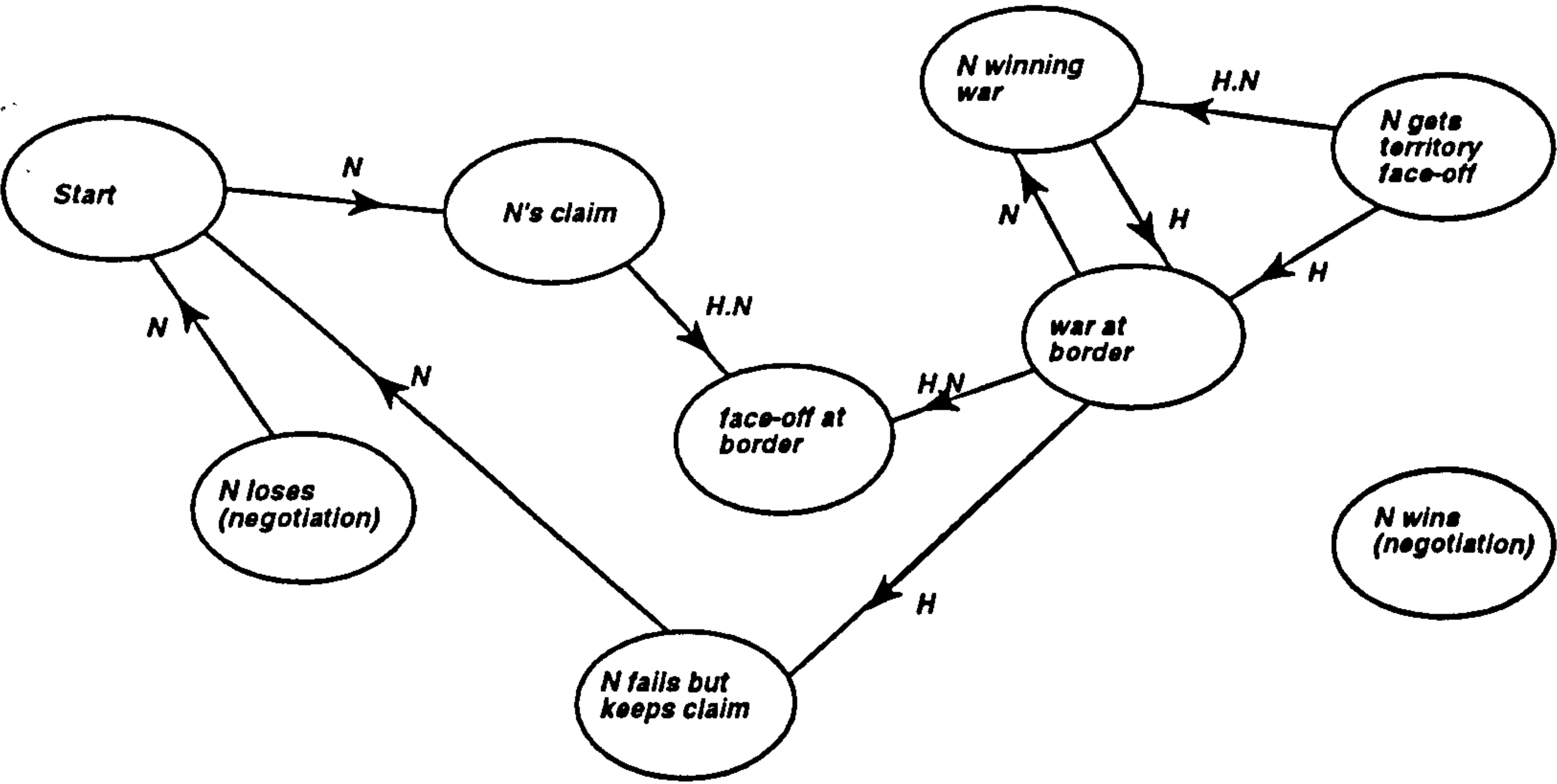


Figure 49: Directed Graph of Postage Stamp Crisis

The network shows certain interesting characteristics. The pair of arrows between the states *N* winning war and war at border indicate that to the extent that *H* has the power to drive *N* back, he will do so, causing the front to shift back towards the Nicaraguan side. Similarly if *N* has the military advantage then naturally *N* will drive *H* back towards the territory in *N*'s greedy gaze.

State *N* wins (negotiation) is not achievable, not because it is impossible for such a state ever to exist but because the implications of the power expressions in Table 47 and the preferences of table 48 mean that there is an implicit assumption that the Hondurans have the power to prevent it. This is not merely a construct of the method, but a result of the intelligence implications of the information in the process.

The diagram reflects accurately the early stages of the crisis, in that it is easy to see that the first steps will be from start to *N*'s claim, (the issuing of the eponymous stamp) and then to face-off (state 5 in previous tables). The diagram then indicates that there is either insufficient power or no motivation to move from state 5 face -off which existed from 3 September until the resolution.

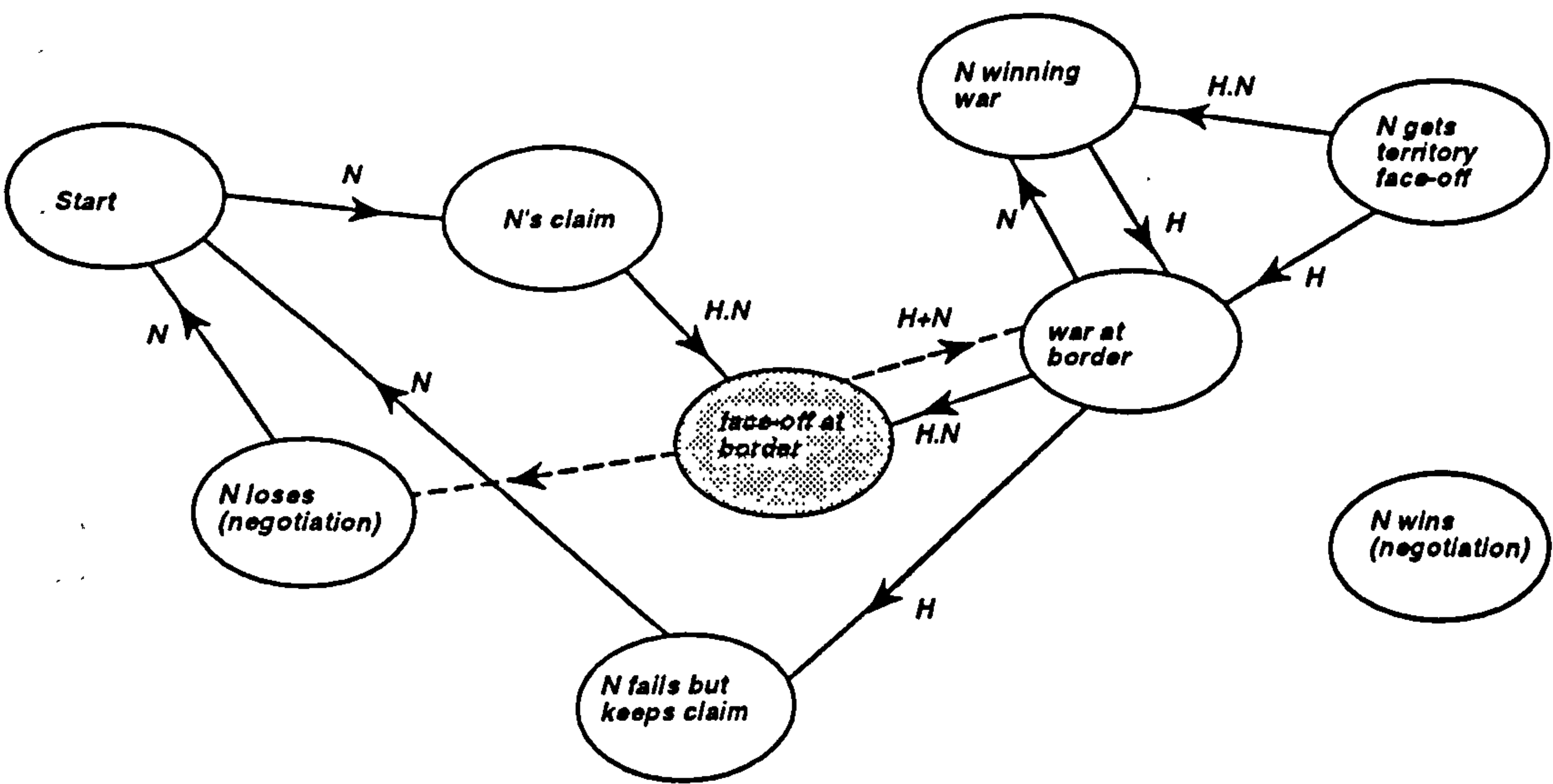


Figure 50: The effect of international action: the preference ordering of *N* was altered

This is in fact the case. Examination of Tables 46 47 and 48 will show that from state 5 (face-off) there were two possible routes out to states 6 (war at border) and to state 9 (N loses (negotiation)). These are prevented by respectively the preference orderings of H and N .

The activities of the international team, then, can be interpreted as being aimed at changing the motivation of N with respect to the relative preference of state 5 (face-off) versus state 9 (N loses (negotiation)). The arguments brought to bear would have concentrated upon the undesirability of N losing international respect and possibly even trading strength through international action. Similarly, the activities of the international community would be interpreted validly as seeking, defensively to prevent H precipitating the face-off into a conflict on the border. Again this would have been implemented by arguments pointing out the undesirability in the eyes of the world of undergoing the transition.

We thus see that the activities of the international community (Costa Rica, Venezuela and US) was to change the motivation (preference ordering) of N on a temporary basis, so that a relaxation of the position became possible to state 9. What was perhaps not understood at the time was that moving to state 9 (N loses (negotiation)) was not an equilibrium state, and that N in a unilateral action actually considered that the negotiation had resulted, not in a resolution of the conflict, but merely in a restitution of the start state.

The result was the flare-up in 1957, where the game essentially follows a similar initial trajectory (Brecher op cit, p 234)

Bottom-up (Fraser & Hipel) approach to state generation for the Postage Stamp Crisis

Tactical Choices

Within the context of the conflict described above one can characterise the freedom of action of the players by a schema similar to that of Table 49.

Postage Stamp Crisis																				
Bottom-up Generation																				
Nicaragua	claim territory	0	0	1	1	1	1	1	1	1										
	move troops fwd	0	0	0	0	1	1	1	1											
	invade H	0	0	0	0	0	0	1	1											
	enter negotiation	0	1	0	1	0	1	0	1											
	accept negotiation	0	1	0	0	0	0	0	0											
Honduras	move troops fwd									0	0	1	1	1	1					
	invade N									0	0	0	0	1	1					
	enter negotiation									0	1	0	1	0	1					
	accept negotiation									0	1	0	0	0	0					

Table 50: The tactical choices available to each player separately

Here we see the compatibility of the tactical choices for each player alone. Clearly some tactical choices cannot be made at the same time by a player, and Table 50 illustrates those combinations which are mutually feasible by a vertical word of 0s and 1s where 1s represent the choice being made by he player and the 0s represent the choice being rejected.

We now consider the combinations of choices available to *N* and *H* together, and these are shown in Table 51. Here we have rejected any combinations of tactical choices made by *N* and *H* which are not compatible one with the other.

Postage Stamp Crisis																				
Bottom-up Generation II																				
Nicaragua	claim territory	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	move troops fwd	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	invade H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
	enter negotiation	0	0	0	1	0	0	0	1	1	0	0	0	1	1	0	0	0	1	1
	accept negotiation	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Honduras	move troops fwd	0	1	1	0	0	1	1	1	0	1	1	1	1	0	1	1	1	1	1
	invade N	0	0	1	0	0	0	1	0	1	0	0	1	0	1	0	0	1	0	1
	enter negotiation	0	0	0	1	0	0	0	1	1	0	0	0	1	1	0	0	0	1	1
	accept negotiation	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
index no.		0	8	12	51	256	264	268	298	302	384	392	396	426	430	448	456	460	490	494

Table 51: The jointly feasible tactical choices available to *N* and *H*.

It is noted that when a comparison is made between the outcomes generated by the Fraser and Hipel method there is little overlap. The Fraser and Hipel bottom-up method generates twice as many states, but only 7 of these correspond in any direct way to the value-based states generated in the top-down value-based analysis above. There is more detail in the Fraser and Hipel method, but this detail is in areas where the players do not judge it to be important. For example there are 5 states involving an invasion of Nicaragua by Honduras which do not appear as relevant in the top-down method. It could be argued that these states could be rejected by an overall feasibility judgement after the application of the bottom-up method, but this would be equivalent to applying judgements about the value systems of the participants without declaring what those assumptions are.

It is also observed that two states (3 and 9) representing whether a border change has occurred or not are not discriminated by the bottom-up method.

Lastly it is observed that Table 51 only includes the states generated bottom-up by the tactical choices of the two players *N* and *H*. If we were to include the possible tactical choices of the international community, a level of detail would result which would swamp the characterisation of the situation by the value judgements of the players. Of the order of 50 states could be expected to result from combinations added when the tactical choices of *I* are included.

top-down index	bottom-up index	
7	0	Start position
	8	Nicaragua not threatening; H has troops at the front. No negotiation occurring.
	12	H has invaded N without N claiming the 'stamp lands'
	51	All parties have withdrawn claims and troops and have accepted the negotiated settlement
4	256	Nicaragua lays claim to 'stamp lands' by issuing the postage stamp.
	264	H brings troops forward in response to stamp claim. Nicaragua has no troops deployed
	268	H invades unopposed in response to claim. N has no troops forward.
	298	Parties enter negotiation (as yet unresolved) no troops deployed
	302	Parties enter negotiation (unresolved) in a context of H having invaded N (N has not withdrawn its claim)
	384	Nicaragua brings troops forward to support its claim. H has not responded
5	392	Face -off. H and N have troops forward. No invasion
	396	H invades N. N holds position with forward troops
8	426	Parties enter negotiation with H and N having troops forward.
	430	Parties negotiating after H invades N
1	448	Nicaragua invades without opposition.
1	456	Nicaragua invades with opposition from Honduran forward troops
02-Jun	460	Widespread war including counter-invasion. No negotiation
	490	Parties negotiating in context of Nicaraguan invasion.
	494	Parties negotiating under conditions of general war

Table 52: The mutually feasible tactical choices for the Postage Stamp Crisis together with a brief pen-picture of each state

Chapter 9: Powergraph in practice — sensemaking and planning

Introduction

In the Chapter 7 the procedural aspects of the Powergraph approach were described and some of the underlying analytical issues discussed. In this chapter, through the examination of two case studies, the more practical aspects will be addressed. In particular, the generation of an action plan from the directed graph and the connection between that action planning and the sensemaking of the problem environment are discussed.

The two case studies described in this chapter are *BAe's Project Staffing*, where the negotiating moves necessary to achieve a particular project appointment on an international project are elucidated and *The Spanish Mayor*, an examination of the difficulties confronting a local politician who is in danger from a blackmailer.

They are very different one from the other. The *BAe Project Staffing* case is a report of a real life intervention on behalf of BAe's project organisation, in the form of Mr. Robert Irvine, who was required by his company to generate a plan by which he would take up a position as Risk Manager on the international NATO frigate programme. Though the task may appear less than strategic, it must be borne in mind that the importance of the project to the company, for reasons which can be inferred from the outcome of the *Battle for Trafalgar* case, was very high. It would not be exaggerating to state that the ability of BAe to remain a contender in the naval prime contractorship market was determined by the degree to which it could claim to have controlled the risk inherent in such projects. The position of Risk Manager was, therefore, a strategic one for the company. The case study is strictly *ex ante*, and can be compared with the events which transpired after the analysis was complete. The main lessons to be learned from the case surround the defensive action planning required to bring about desired outcomes, and the consequences which resulted when the defensive planning was not implemented.

The Spanish Mayor is an *ex post* case in reality, but one where the Mayor's real life consultant, S. Giovanni Manunta, was willing to provide the information necessary to carry out the analysis as if the events were taking place at the time of the analysis. This was a most effective method of testing the efficacy of Powergraph; normally an *ex post* case is subject to posterior knowledge on the part of the analyst as to the real outcomes, and there is a real risk that, even subconsciously, the theory is made to fit reality. In the case of the Spanish Mayor case study, however, the consultant was punctilious in not revealing the actual events except at the end of stage one of the analysis and at the end of stage two, the last iteration. The main purpose of describing the case is to illustrate the high degree of connection between action planning and sense making in a complex and imperfectly understood situation.

The next chapter contains a case which links together the EFAR strategic futures analysis and subsequent Powergraph analysis in one *ex ante* case, that of the *OSF's Strategic Future*.

Planning framework for Powergraph

Planning Paradigms: acceptance and manipulation

The planning process can be characterised by the extent to which the planner assumes that the assumptions inherent (and indeed declared) in the Powergraph process are immutable.

At one end of the scale is the assumption that the diagram is, in some sense, 'correct'; that the motivations and powers inherent in it are correctly stated. With this assumption the planning procedure essentially consists of operationalising the trajectories predicted. By this is meant the implementation of practical measures to enable the practical aspects of the formal transitions of the Powergraph directed graph. Where a transition implies the release of information, the press release must be planned and published, where the transition implies the purchase of another company or the securing of a project, the practical implementation must be secured. The planning is then, under the assumption that the directed graph is wholly predictive, the conventional procedure of operational planning and falls

outside the scope of this work.

There are two alternative assumptions about the knowledge in the Powergraph model, however. First, one could assume that the information is subject to error, and that an investigation into the effect of errors (a sensitivity analysis) would be wise. Here a check is made on the effect of single changes in the powers and motivations of players. Sometimes changes will have no effect; on occasion small changes in, for example the preference ordering, will have dramatic effects on the stability of equilibrium analyses.

Second, we can carry out such an analysis not from the essentially neutral point of view of an error effects analysis (i.e. where might the model be in error), but from a manipulative point of view (i.e. which elements could we manipulate to improve the prognosis from our point of view). These manipulations can be upon the preference ordering of participants, or to the powers implied in the boolean expression of the directed graph. Clearly such considerations can be a fruitful source of action planning and sensemaking.

General procedures for Powergraph Action Planning

The process of planning under the Powergraph framework can now be seen as some or all of the following elements

- a) selecting a desirable outcome
- b) identifying the trajectories which lead to that outcome
- c) defending the desired trajectories against unwelcome amendment
- d) identifying actions which could result in new trajectories emerging, some of which may lead to improved end positions
- e) identifying the effects of errors in the assumptions of the model.

These steps will now be illustrated using the vehicle of the *BAe Project Staffing* case as a real-life example.

BAe's Project Staffing: Negotiation for Organisational Position

Background

This analysis is concerned with the manoeuvring for a post in an international defence project known as CNGF. The project has an existing procurement organisation and a parallel industrial organisation known as the IJVC (International Joint Venture Company). GEC are the major British contributor to the IJVC and hold the all important Technical Director slot. BAe Systems and Services Division are in partnership with GEC as their subcontractor and there are contributors from other countries (France and Italy) in the IJVC.

Safety is a systemic issue for the design and the client company, BAe SSD, have an expert, known here as RAI, who has been instrumental in increasing the awareness and the level of technical skills associated with safety. There is no doubt that RAI is, *ceteris paribus* the preferred choice, but naturally company and national issues come into the equation as well as technical skill, and there is a *de facto* conflict of interest between major company and organisational elements such as the Ministry of Defence (UK), GEC, BAe and individuals within the IJVC.

The objective of the exercise is to indicate what pressures should be brought to bear on various contributors to the project in order to ensure that RAI is appointed within an appropriate organisational structure in order that the project interest and company interests of the client company can be satisfied.

The specific objectives then are:-

- a) to describe the structure of a potential conflict of interests between the interested parties
- b) to indicate effective development strategies in order to bring about (or condition) desirable outcomes for BAe.

This safety management task may be carried out either within the structure of the IJVC or,

effectively as a subcontract task to one of the contributing companies. The post (if it is established) could be appointed from outside UK or from within UK; if the latter, it could be filled by a BAe man or a person from another company; if by a BAe man it could be RAI or a different person. Lastly, the appointment could be delayed for an indefinite period. These options are of importance in the establishment of states.

The information summarised here resulted from a series of meetings with company representatives (Snarey 1996a). In particular the analysis method was offered to the company through their consultant, Mr. VL Snarey on August 18th 1996, and a meeting then took place between Mr. Snarey and company representatives on 19th August. A further meeting between the writer and Mr. Snarey resulted in further work on the state definitions in preparation for a meeting with a senior company representative on Wednesday 28th August (Snarey, 1996b).

The Players

- T* The technical Director of the IJVC, John McIver from GEC
- P* The Engineering Director of BAe SSD, Peter Chamberlain
- B* The BAe project organisation, headed by John Crashley
- M* The UK Ministry of Defence
- G* The GEC project and contracts organisation
- J* The Joint project organisation Safety Manager, Alessandro Pini
- S* BAeSEMA, the naval contracting organisation of BAe

The States

Table 53 below illustrates the possible states resulting from the options described in the background section. There are in theory, some 24 states, but many of these are undistinguished by the players, and so are clustered as shown.

State Definitions		Source of Appointee			
Configuration		Outside UK	Inside UK		
			Not BAe	BAe	
				Not RAI	RAI
	No SM	1			
	SM outside JVC	2	3	4	4+
	SM inside JVC			5	5+
	Dispersed with SM	6			6+
	Dispersed without SM	7			
	Delay	8			

Table 53: State definitions for BAe Project Staffing case

Preference Ordering

Table 54 below shows the preference ordering resulting from a meeting on 28th August between the writer, Mr. Snarey and Mr. Irvine, Warship and Nuclear Safety Manager, BAe.

Preference ordering for organisational negotiation study							
	T	P	B	M	G	J	S
1	11	11	10	11	11	11	11
2	9	9	9	6	7	1	9
3	1	8	8	5	1	6	8
4	1	5	5	2	3	1	5
4+	2	4	3	2	3	1	3
5	7	3	4	2	5	1	3
5+	6	1	1	1	5	1	2
6	7	7	7	8	10	7	6
6+	5	6	6	7	7	7	6
7	10	9	11	9	10	10	10
8	1	2	2	10	1	9	1

Table 54: Preference ordering for BAe Project Staffing case

The BAe candidate, RAI, is generally well supported but with certain provisos on the part of different agencies. For example, the GEC project organisation, G, would prefer to have a non-BAe safety manager appointed for obvious reasons. Other factors do affect the preference ordering of parties. Certain participants would prefer a delay in appointment

rather than accept an unsatisfactory solution.

At the meeting on the 28th August, the following points also emerged (Snarey 1996b).

- a) BAe has agreed a number of seats on the IJVC which have not been taken up. This gives them some leverage over their prime contractor, GEC. Contractually these seats must be taken up by BAe.
- b) The safety function is already being covered in an informal way by RAI. It is a function represented in the organisation at a relatively senior level, being one of only three functions which act at the 'superblock' level, which is normally reserved for major engineering functions. Effectively, today we have a safety manager but he is not formally appointed.
- c) It appears that the technical director IJVC, (*T*), would be happy for RAI to continue to give informal support indefinitely, not least because the GEC company would be unable to provide an adequately qualified replacement. There is also a hint of not wishing to precipitate a political struggle over a particular appointment unnecessarily.
- d) The engineering director of BAe SSD, (*P*), should be viewed as a channel of communication rather than as a direct participant in the struggle except for those states where a BAe engineering staff member is or is not appointed, the job having been given to BAe. In these circumstances his assent is required for the appointment.
- e) The IJVC requires an appointment to be made and UK MoD support the general idea of appointing a safety manager early in the project.
- f) BAe appears at present to be best placed to provide that safety manager.
- g) The relationship between BAe's naval business and that of BAeSEMA, the naval contracting arm (a joint venture between BAe and SEMA Group Ltd.) is

changing. It is very likely that the entire naval business of BAe, other than its weapon system business (BAe Dynamics) and the highest prime contract function will be given to BAeSEMA to execute. Existing staff in the main part will be seconded into BAeSEMA. This presents a dilemma as far as the model is concerned, since the motivations, and therefore the preference orderings of the participants *B* and *S* are uncertain. A conclusion was reached whereby *S* is imbued with the motivations of *B*. The argument is as follows. If BAe is in its present leadership position, then BAeSEMA will have the same motivation as its contract holder. If, on the other hand, BAeSEMA leads the activity, by extension, its motivation and preferences will be the same as BAe's present ones since the same commercial pressures will apply.

h) Under any new BAeSEMA regime, the acceptability of RAI to fill any BAe post is unknown, but the best assumption is that his credibility is the same under any new intercompany arrangement as is the case today.

Feasibility of transitions

Table 55, below, shows the influence of various participants upon the feasibility of the transitions between the states. In spite of having over a hundred cells, the matrix is easy to derive, because the participants having power over the appointments are very well defined. The IJVC technical director has the final say subject to effective veto by the IJVC (*J*) and UK MoD (*M*). There is no divergence of policy discernible between the IJVC technical director and the remainder of the IJVC organisation. Hence each cell contains *T.M.J.* Additionally, where a BAe selection has to be made as to the appointment of a safety manager, *B* and *P* have power to control that appointment. Hence some cells contain the expression *T.M.J.B.P.* Where an actor has equal preference ordering between states the relevant element of the boolean expression is shown in lower case.

Feasibility of transitions											
	1	2	3	4	4+	5	5+	6	6+	7	8
1	TMJ	TMJ	TMJ	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJ	T+M+J
2	TMJ	TMJ	TMJ	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJ	T+M+J
3	TMJ	TMJ	TMJ	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJ	T+M+J
4	TMJ	TMJ	TMJ	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJ	T+M+J
4+	TMJ	TMJ	TMJ	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJ	T+M+J
5	TMJ	TMJ	TMJ	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJ	T+M+J
5+	TMJ	TMJ	TMJ	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJ	T+M+J
6	TMJ	TMJ	TMJ	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJ	T+M+J
6+	TMJ	TMJ	TMJ	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJ	T+M+J
7	TMJ	TMJ	TMJ	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJ	T+M+J
8	TMJ	TMJ	TMJ	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJ	T+M+J

Table 55: The feasibility of transitions for the BAe Project Staffing case

Motivated Power

The table below, Table 56, shows the effect of incorporating the motivations of Table 54 into Table 55. Table 56 exhibits a large number of motivated transitions and is best analysed by inspection of the matrix itself rather than the normal method adopted with sparse matrices, namely inspection of a network diagram.

Interpretation of motivated power matrix

- a) Today's state is considered to be state 1, from which any other state is accessible.
- b) There are three rational equilibrium states, indicated by empty rows (other than the leading diagonal). These are states 4+ and 5+. The latter is highly favoured by the client, but the former, 4+, is disliked, mainly because it does not provide the in-project influence necessary to control safety within the engineering function.
- c) State 4 leads inexorably to state 4+.
- d) If a delay (state 8) is accepted as an output from state 1, the client is greatly disadvantaged because there is no route to the desired state of 5+. In fact the result is likely to be an acceptance of state 3 (rank order 8 by BAe). Delay, therefore is to be avoided at all costs.
- e) Because of the high connectivity of the other states one with another, the best tactic would appear to control, in the first instance, the transition out of state 1. Any temporary agreement to discuss, for example, a solution based on state 6 would move the resolution of the situation no further on,. The consequence for the action plan, therefore is to ensure that the best arguments are presented in the first instance to strengthen the clear possible route from 1 > 5+ direct.
- f) Note the boolean expression for the sustainment power at state 5+, *TMJBP*. If this solution is proposed efforts will have to be made to reinforce the adherence of all 5 parties to this solution; a weakening of resolve by any one of the five will force the system unstable

Motivated power In transition		1	2	3	4	4+	5	5+	6	6+	7	8
1			TMJ	TMJ	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJ	T+M+J
2		.		TMj	TMjBP	TMjBP	TMjBP	TMJBP	.	.	.	.
3	
4		.	.	.		TMjBP	.	.	.	.	.	.
4+		TMJBP	.	.	.	.	.	.
5			TMJBP	.	.	.	.
5+		TMJBP	.	.	.	.
6		.	.	TMJ	.	TMJBP	TMJBP	TMJBP	TMJ	TMJBP	.	.
6+		.	.	TMJ	TMJBP	TMJBP	.	.	.	TMJ	.	.
7		.	TMJ	TMJ	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP	TMJBP		.
8		.	.	TMJ	.	.	.	.	.	.	.	TMJ

Table 56 Motivated power in transition for the BAe Project Staffing case

again, potentially.

g) State 5 is essentially equivalent to the highly desired state 5+, since any exit must be to state 5+.

Figures 51 and 52 below show respectively the overall directed graph for the case and a reduced diagram which illustrates the paths to the most desired state, 5+. This directed graph is a particularly difficult one to draw in such a way as to be easily accessible to the reader. In order to help understanding the boolean expression have been suppressed: reference should be made to Table 56, from which Figures 47 and 48 derive. State 1 is connected to each of the other states and these connections are not shown explicitly. It can be seen that, since there are paths from most states to 4+, which is the equilibrium less desired than 5+, it is highly desirable, in terms of robust planning, to attempt a direct transition to state 5+ from the start, rather than to run the risk of the motivations of other players (which are neutral in some cases) dominating the transitions. A delay to state 8 would be tempting but unsafe.

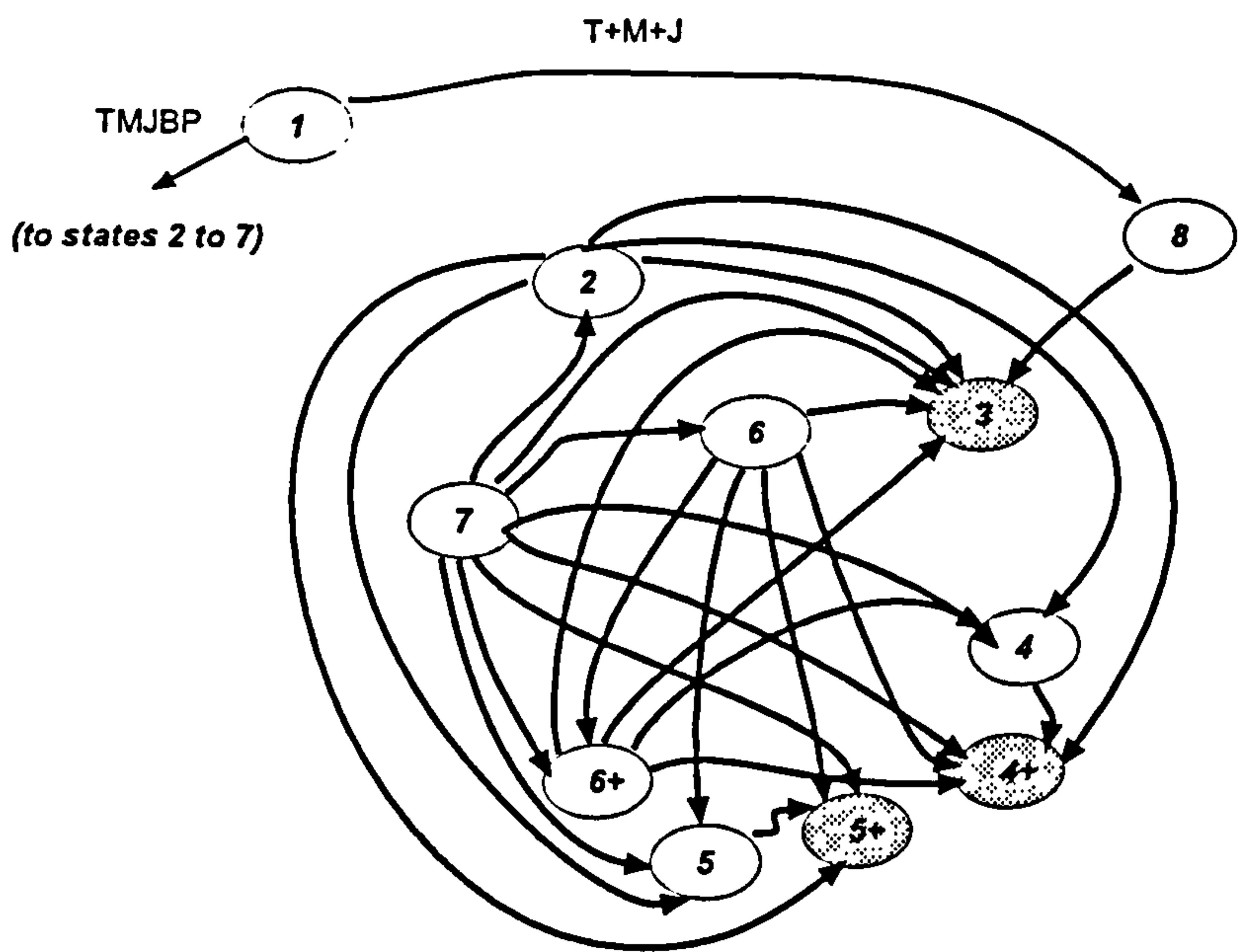


Figure 51: Directed Graph for BAe's Project Staffing Case

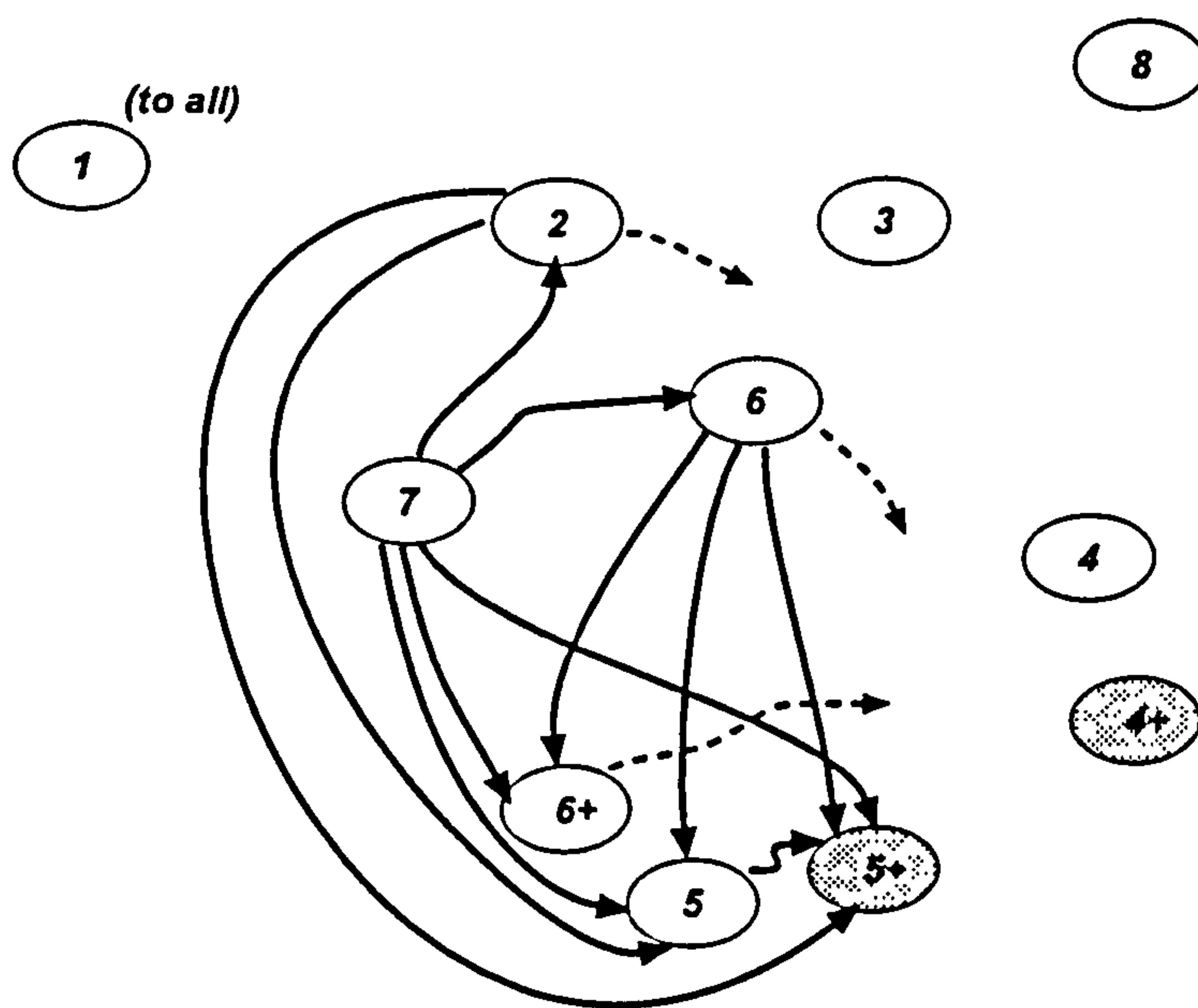


Figure 52: The paths to the most desired state, 5+

Selecting a desirable outcome

This step is a straightforward one, resulting as it does from the already declared preference ordering of the preference ordering matrix.

A complication can arise when a desired state is not accessible within the directed graph. In this case, until the identification of new trajectories, the assumption is made that the outcome (equilibrium) states shown in the diagram are the only outcomes accessible from the start state.

In the present case study, state 5+ is easily recognised as the most preferred outcome. The BAe specialist, RAI, is desirably placed within the international project both for the reason that he is considered to be the best man for the job, but also because from BAe's point of view, having a well-respected man in such an important position is a desirable state of affairs.

Identifying the trajectories which lead to that outcome

This is a straightforward extraction of the accessible paths from the diagram. The cases shown in this work are sufficiently simple to allow enumeration by inspection.

Here we see the following trajectories which may lead to the desired outcome together with the parties controlling the transitions:-

- 1 (TMJBP)6 (tMJBP) 5 (TMjBP) 5+
- 1 (TMJ) 7 (TMJBP)5 (TMjBP) 5+
- 1 (TMJ) 2 (TMjBP) 5 (TMjBP) 5+
- 1 (TMJ) 7 (TMJBP)5+
- 1 (TMJ) 7 (TMJBP)6 (TMJBP)5+
- 1 (TMJ) 2 (TMJBP)5+
- 1 (TMJBP)5+

The process of delineation is the straightforward procedure of developing a tree, starting with the desired end point and declaring each possible entry state to the nodes of the tree.

Here the originating tree was:-

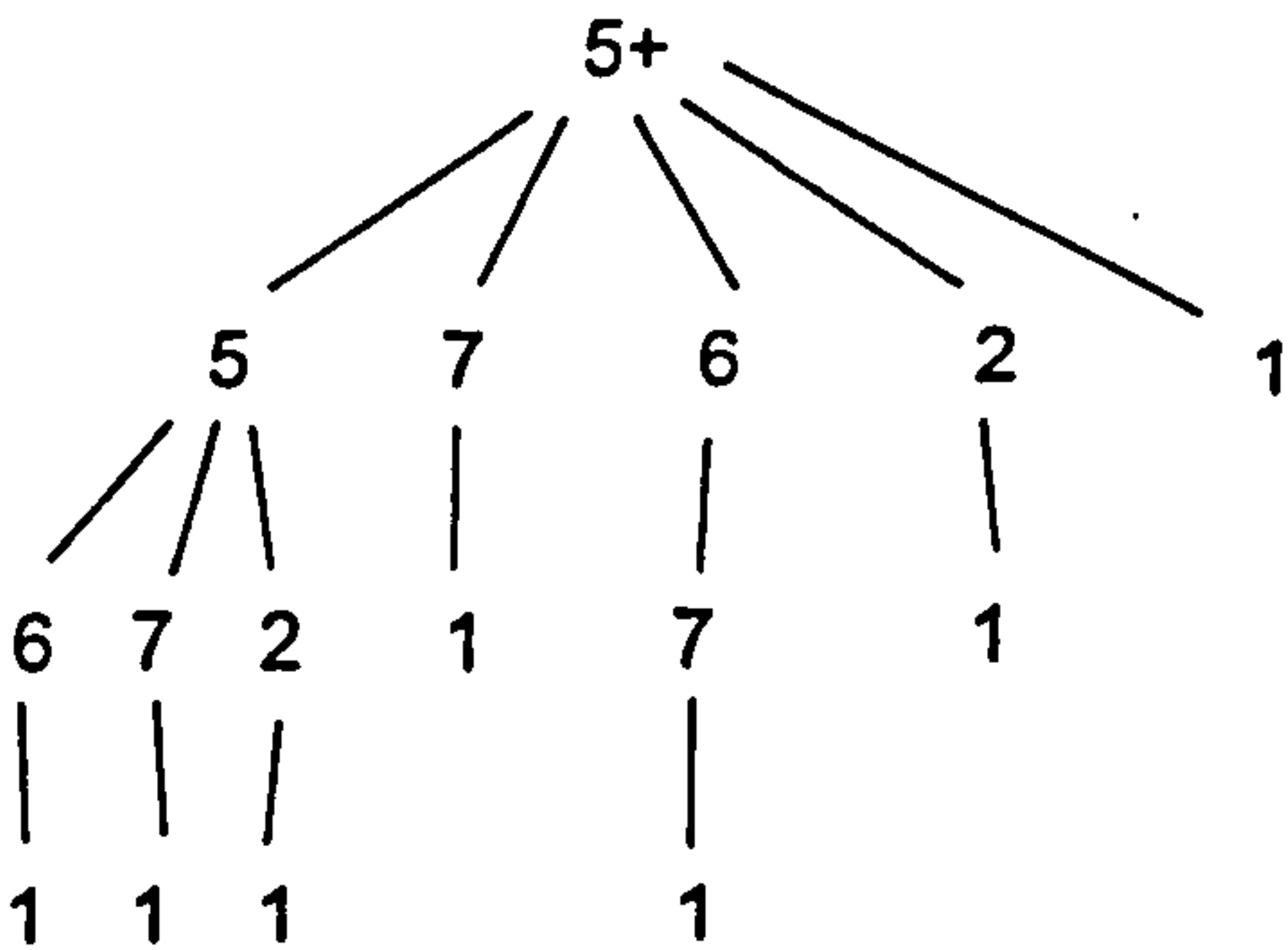


Fig 53: Tree of possible paths to desired state, 5+ BAe's Project Staffing case

In this case the most appropriate path from state 1 to state 5+ is the direct one. Planning commences with this path as the preferred one. If this path is seen to be too risky or

practically infeasible, the alternatives of $1 > 2 > 5+$ or $1 > 7 > 5+$ will be considered.

Defending the desired trajectories against unwelcome amendment

There are two elements to this part of the planning approach.

First, the trajectory itself must be defended. Each path to the predicted outcome carries with it a set of assumptions about the powers, motivations of the participants in the conflict.

There is a possibility that the preferences, in particular, of these participants may change, or that through the activities of other interested parties, the powers of other participants may be altered. Defensive measures need to be planned to ensure that undesirable changes do not occur.

In the case in hand we see that the path from state 1 to state 5+ is under the control of the boolean expression *TMJBP*. If this path is to be followed each of the parties who have both the power and the motivation to enable it must be kept empowered and supportive.

T the GEC Technical Director of the IJVC

This individual, who in some respects represents both GEC and the IJVC is empowered by his authority as the appointing person for staff within the IJVC. It is unlikely that his position is threatened in any way. Of more importance is the need to ensure that *T* is made aware of the competence of RAI in terms of his potential contribution to the IJVC technical effort. The main aim then is to bolster what should be an already strong desire on his part to appoint a competent individual to his team. Equally important is to guard against the possibility that *T*'s home company, GEC, should identify the post as an important one for them, so that the advocacy to *T* must include a commitment that *T* will behave in a neutral fashion.

M The UK MOD

The MOD will be happy with RAI's appointment, but must be maintained by being allowed access to BAe's safety information in order that they will naturally assume a BAe ownership

of the safety function. The empowerment of the MOD is through the contract which they hold, over the IJVC.

J The IJVC Safety Manager, Capitano Alessandro Pini

Again, the main line of support here is through the competence of RAI who is already known to known to *J*. It is important to ensure that *J* is not subject to international advocacy which might provoke him to take a position which is anti-UK in terms of this particular appointment. Discussions with staff indicate that this is unlikely in that the UK at this time were clearly seen as having a high level of competence in this respect.

B The BAe project manager, Mr. John Crashley

No difficulties were anticipated in respect of the BAe Project function

P The Engineering Director of BAe SSD, Mr. Peter Chamberlain

The BAe engineering director is viewed as likely to be supportive of the appointment of RAI to this post if the transition were to be judged to be feasible.

Second, escape paths from the desired trajectory need to be identified. Each state on the assumed path is examined and alternative routes are marked. The desirability of each alternative path is assessed and the actions needed to prevent the alternative being taken are identified. A particular set of paths emerging from a state may present what game theory refers to as an order of play issue. In such a situation the outcome of a game turns on the order of choice of players. In the practical analysis of directed graph models, the order of play must be determined by reference to the outside actual situation, and can form the basis for critical elements of an action plan. Examples of order of play problems can be seen in many of the directed graphs in this work. In particular the *Battle for Trafalgar* case shows an order of play problem controlled only by BAe from the state start and in the present example state 6 can be seen to present a similar problem. Clearly some resolution can be achieved if a single player or small group of players whose choices are consistent control the choice, but multiple transition choices which do not present straightforward

single player order of play issues can be difficult to predict, and in many cases the trajectory of the game is essentially unpredictable. An example of such considerations can be seen in Figure 50 (*Postage Stamp Crisis*) where, were the situation to be forced to state war at border, an international body might be inclined to put external pressure on *H* and *N* in order to ensure that either *H* (Honduras) accepts the Nicaraguan claim or that *N* and *H* act together to stop fighting.

In the present case the trajectory $1 > 5+$ is the preferred development path. Here state 1 presents the following escape routes

1	(<i>TMJ</i>)	2	{9,6,1}
1	(<i>TMJ</i>)	3	{1,5,6}
1	(<i>TMJBP</i>)	4	{1,2,1,5,5}
1	(<i>TMJBP</i>)	4+	{2,2,1,3,4}
1	(<i>TMJBP</i>)	5	{7,2,1,4,3}
1	(<i>TMJBP</i>)	6	{7,8,7,7,7}
1	(<i>TMJBP</i>)	6+	{5,7,7,6,6}
1	(<i>TMJ</i>)	7	{10,9,10}
1	(<i>T+M+J</i>)	8	{1,10,9}

The preference ordering of the empowered parties is shown above thus {5,8,1}. Examination of these preference orderings indicates that some escape paths are strictly dominated, in the sense that each and every empowered party prefers at least one other escape path. Thus, each of *TMJBP* prefers transition $1 > 4$ over transition $1 > 6+$. We can therefore discount state 7 (dominated by 3), state 6 (dominated by state 4) and state 6+ (dominated by state 4). All other states have at least one escape path which at least one empowered party prefers.

Thus the remaining potential escape paths from our desired trajectory are

- 1 (TMJ) 2 {9,6,1}
- 1 (TMJ) 3 {1,5,6}
- 1 (TMJBP) 4 {1,2,1,5,5}
- 1 (TMJBP) 4+ {2,2,1,3,4}
- 1 (TMJBP) 5 {7,2,1,4,3}
- 1 (T+M+J) 8 {1,10,9}

The planning task, then is to identify the players who can prevent these undesirable transitions and present advocacy to them to bolster their power and motivations against the undesired transition *vis-a-vis* the desired transition of 1 > 5+.

We compare the preference ordering of the players for state 5+ against those of the possible escape paths...

- 1 (TMJBP) 5+ {6,1,1,1,1}

... and we see that the advocacy must be aimed at ensuring that the players *MJP* (we are *B*) continue to be aware of the desirability of ending up at state 5+, where they will be favoured with an expert safety manager from a competent company in a timely manner (etcetera) and by advocating to *T* (the most dangerous of the empowered parties in this respect), that other escape paths for him (say to state 4 or 4+) will face opposition compared with the 'natural choice' of 5+. The details of such arguments are a function of the particular situation, and here the vehicle was chosen to be a safety management report from Mr. Snarey, in which the main line of advocacy was the timeliness of appointment, which served the parochial interests of the parties well.

Identifying actions which could result in new trajectories emerging

Here the objective is to examine the directed graph for changes which can feasibly be

brought about which could result in the appearance of new paths some of which may result in more favourable outcomes. *The Postage Stamp Crisis* (Figures 49 and 50) shows this approach to effect. By acting so as to change the preferred ordering of participants, the international community, *I*, makes the transition **face-off at border > N loses (negotiation)** a feasible one, thereby (from the international community's point of view), opening up a path away from undesirable equilibriums. It should be noted here that the international community's action does not result in an equilibrium (history shows a flare-up of the situation some years later) but rather a neutralisation of the previous equilibrium. *The Postage Stamp Crisis* shows a cycling around the states **Start, N's claim, face off at border and N loses (negotiation)**.

The process essentially involves examining the differences between the motivated power matrix and the transition power matrix to uncover which changes might result in feasible transitions appearing. The effect of these potential; new transitions is then determined by inspection.

Comparison of Tables 55 and 56 show that in this case all states are immediately accessible from state 1, the start state. The connectivity of the graph is high in general and the only state which, by inspection appears to present potential for further development paths is state 8, delay. This state is potentially highly accessible from state 1, since it is under the control of any one of *T* or *M* or *J*. If state 8, then does emerge by failure on BAe's part to bring about the desired transition, it will be seen that the model predicts a devolution to state 3, which is not desired by BAe. Examination of Tables 55 and 56, then indicate that more desirable development paths from 8 to 4+ or 5+ could result if *TMJBP* could be persuaded that 4+ or 5+ respectively were preferable to state 3. Such persuasion would render the situation less risky from the client's point of view. We compare the preference ordering for the empowered players (*TMJBP*) for the three end states in question, 3, 4+ and 5+ against that for state 8.

3 {1,5,6,8,8}

4+ {2,2,1,3,4}

5+ {6,1,1,1,1}

8 {1,10,9,2,2}

We see that T is the controlling influence. All other players see a preferred result in state 5+. The client therefore needs to discover methods for persuading T that if a delay occurs, it is preferable to resolve the situation other than to state 3. Because of the disparity of preference ordering for players $MJBP$ between state 3 and both states 4+ and 5+, it should be possible to mobilise them in the persuasion of T that state 5+ is not as bad as he thought (or that we assume he thinks). We observe however, that the disparity for T between the preference ordering for state 3 and that for state 5+ is substantial; (1st vs. 6th), and we may be more likely to achieve a change of only one unit by persuading T that his preference orderings of 1 and 2 respectively for states 3 and 5+ may be reversed. Such a line of argument would then open up a new path from state 8 to state 5+, presenting BAe with a credible risk reduction strategy. It will be seen in the section below on the evolution of the actual situation, that BAe failed to carry out this risk reduction preparation with undesirable results.

Identifying the effects of errors in the assumptions of the model.

The last step in the planning procedure is closely connected with the previous one, and amounts to a sensitivity analysis of the effects of errors in the assumption of the model on the stability analysis. While it would in theory be possible to check small changes in every assumption of empowerment and preference ordering such an approach would be impracticable without computer support. In practice this sensitivity analysis is limited to the path selected for development at step 3 of this procedure.

The judgements applied to target this sensitivity analysis are essentially structural ones

similar to the inspections of the directed graph in order to determine potentially fruitful new development paths, but the following check list is appropriate for this examination

Are any previously unidentified players controlling this transition?

Are the preference orderings correct in view of the order of play considerations above?

Are any players dominated politically in a boolean expression controlled by AND terms?

In the case in hand checks are made as to the empowerment of parties in moving from state 1 to state 5+. No additional players were identified as being important, although the MD of the IJVC was considered as a possible foil to any desire for a GEC interest to be served by *T*. It is clear that the disparity in each party's preference ordering between states 1 and 5+ indicates a clear cut difference in preference which is unlikely to be erroneous.

It is important that the sensitivity analysis is delayed until the last step of this procedure for two reasons. First, because of the high degree of commonality of thinking between the process of seeking additional favourable paths within the diagram and the sensitivity analysis step, it is more efficient to delay the latter. Second, the process of sensitivity analysis is not just an examination of the directed graph ; it is also a re-examination of the conflict situation statement itself, and we shall see in the next case, *The Spanish Mayor*, that the sensitivity analysis can result in a wholesale rewriting of the model as understanding is gained in one iteration and applied in a subsequent one. We shall see, additionally, that the action planning process and the sensemaking process are inextricably bound together.

Action Plan

At the meeting on August 28th, the following action plan points emerged (Snarey 1996b).

1. The danger of delay was clearly recognised. The safety document being prepared for the IJVC by Mr. Snarey would be slanted so as to indicate the effects on the project

safety competence for failing to achieve an early appointment of the Safety Manager.

2. This document was recognised to be primarily aimed at the BAe audience, but it was also understood that equivalent arguments must now be presented to the IJVC Technical Director.
3. In order to ensure that undesirable states are not reached directly from today's state, the slant of the documents describing the function of the Safety Manager would be directed towards the benefits of having the Safety Manager inside the IJVC (state 5 or 5+). If additionally state 5+ can be advocated directly, all well and good; if state 5 is reached first, the transition $5 > 5+$, dominated by *TMjBP* will be strengthened by similar arguments to those already addressed in Mr. Snarey's document.
4. It was understood that arguments must be addressed to all of *T*, *M*, *J*, *B* and *P* in order to ensure that the desirable transitions would result.

Outcome of Situation

The action plan was implemented as described (Irvine, 1996). Mr. Snarey's paper (Snarey, 1996c) and others were amended to take into account the arguments militating against a cautious, delaying approach on the part of BAe.

BAe took a different view, being of the opinion that taking the argument for an early resolution to the interested party would show a weakness to them, thereby sensitising them to the importance of the issue to BAe.

This put them at state 8 in Figure 51. From here there were three possible transitions, to 4, 4+ and to 3. Examination of the motivated power matrix of Table 56 shows that in each case *TM* and *J* are in control of the transition, with, in the latter two transitions, *B* and *P* also having a controlling interest. Because BAe disliked the thought of ending up at either 4 or 4+, they fought against a resolution, thus keeping the struggle at state 8.

Now the balance of the struggle turned to the transition $8 > 3$. This is controlled by only

M.J., GEC, the MOD and the Joint Project Organisation. BAe thus have no control over that transition, and a safety manager was appointed by agreement with those three parties.

The safety manager appointed was not BAe, but was appointed within the JVC.

Thus the equilibrium predicted was reached, primarily because of the effect of the insistence of BAe that a delay would be safest. The transition $1 > 8$ should have been sanctioned rationally by a recognition of the subsequent (undesirable to BAe) transition $8 > 3$.

There were a number of failures of implementation, not least of which was the failure to advocate a risk reduction path from a state of delay to the desired state. As can be seen from the analysis, such a line of advocacy was already supported by three out of the four controlling parties, and would probably have resulted, if not in a devolution to state 5+, then at least to the almost as desirable state 4+, where a safety manager outside the IJVC is appointed, and he is the universally accepted candidate, RAI.

The Spanish Mayor: A case study in sensemaking and action planning

The second case in this chapter is included in order to illustrate the connection between sensemaking and action planning. It will be seen from the case that the action falls into two sections. First an examination of the situation was carried out with just the information available on the day of the disclosure of the potential threat to the mayor. Certain actions result from this analysis some of which are persuasive in nature, some of which are primarily information gathering. This new information then forms the basis for a new, but connected examination of the situation.

Situation and context

(This section draws on original documentation (Manunta, 1996a) provided by the consultant to the Mayor, and provided by the consultant to the writer on 6th June 1996)

The situation recorded here is a real-life one which took place during the early 1990s and draws on the experiences of an adviser to the mayor of a district in the southern half of Europe. The mayor's past business dealings have perhaps been unwise, and he has held on to business interests which, while appropriate for a private citizen, may perhaps be viewed by some as unwise for a man in public life. He is not a rich man; he lives for the service which he gives to his district and the resulting respect in which he is held by his fellow citizens.

Like many small politicians he is used to the trading of influence and power and has no difficulty with the concepts of utilising information about associates and threats to the advantage of his position.

The general political situation in the district is relatively stable but there is a political atmosphere in the country at large, suggesting a fierce struggle for power between regional interests and federal interests. The mayor has returned to power (which he held for some 15 years) having been ousted for 4 years by the active local opposition party, who have

strong connections through a coalition with the government party in the capital. The mayor did not enjoy being out of power and wishes to avoid the loss of an election in the future if it can be arranged. The Mayor hopes to have some support from the local Chief of Federal Police, but distrusts the Chief of Local Police, who had been appointed by the opposition party during its mandate. He is not sure of his loyalty and believes that he is acting as an informant for the local opposition party. He cannot dismiss him, however, without just cause.

The situation within the country is democratically stable, one of the key political issues being the degree to which regions of the country have autonomy from the capital. To this extent there is a dichotomy of interest between the national (federal) authorities and that of the regional or local government. The government party and the Chief of Federal Police in the region are aligned, in that the Chief of Federal Police sees his future as falling both within the sphere of influence of federal politicians rather than local ones, and within the sphere of influence of the opposition party rather than the party of the Mayor. There is some alignment of interest between the Chief of Federal Police and the Chief of Local Police.

The mayor is concerned. Reports are coming in from his associates that three local policemen have been arrested and are being held locally on a charge of receiving stolen goods, namely motor vehicles and computer equipment. What concerns the mayor most is that in their possession has been found a collection of some 60 tape cassettes which rumour says contain potentially embarrassing information in the form of recorded telephone conversation. The tapes have been sealed and locked away. The mayor is clearly concerned that his unwise business connections will be exposed by some interested party thereby reducing the mayor's political influence in the community. It is not evident to the mayor who it was who invited the three policemen to engage in this alleged surveillance; he knows that he did not instigate it and he suspects that it was done at the request of the Chief of Local Police, but it could equally well be an initiative of the Chief of Federal Police, or as a personal initiative by

one of the policemen (who had already been fined for a similar offence).

The Mayor's Problem

As yet there has been no disclosure of any potentially embarrassing material, but the Mayor wishes to know how the situation might develop, and how he might influence events and individuals in order to prevent an embarrassing release, or, if the situation were to change, to reduce any damage to his reputation which might occur.

The participants and their objectives

A - the Mayor

The Mayor's objective within the situation is to maintain the stability of his position. Ideally he would like to retain the *status quo*, but he recognises that he could be threatened by either the Chief of Local Police (*B*) or by the arrested officers (*C*). Additionally the Chief of Federal Police (*D*) could have instigated the surveillance and may be interested in bringing pressure to bear on the Mayor in order to strengthen his own position. The Press (*E*) also present a threat, but only if they have access to the material on the tapes (and assuming that the Mayor's worst fears about their content is well-founded). The Mayor does not want disclosure of the contents of the tapes and would prefer not to be threatened since, although he is too poor to be blackmailed in any conventional sense, he would not wish to have to agree to political demands by the threatening party in return for that party's silence. He would also like to change the Chief of Local Police in order to have a person loyal to him in that post.

B - the Chief of Local Police

The local Chief of Police is trying to play on both the Mayor's team and the opposition's team. The Mayor (*A*) cannot fire him, but the Chief of Local Police must be careful that he does not alienate his present master unless he sees the Mayor losing power terminally. The objective of *B* is to secure his position and career with minimum trouble. He is known to be a ruthless man. The investigation carried out on the Chief of Local Police revealed

some form of complicity with the arrested policemen (he bought a computer at a suspiciously low price from them). Additionally, he had attended a course in audio and telecommunication security. However, his previous connection is with the opposition party now appeared looser, and he seemed desperate to establish a good relationship with the winner of the political struggle, namely the Mayor.

C - the three arrested policemen

These individuals are interested in minimising the effect of their arrest. They are going to prison, but they will act so as to reduce their sentence.

D - Chief of Federal Police

The Chief of Federal Police owes little allegiance to the Mayor, but rather to the national government coalition. What is not clear, however, is whether *D* had any part in the surveillance in the first place, and, indeed, what is the content of the tapes. He certainly knows of their existence and contents. The objective of the Chief of Federal Police will be to threaten *A* with disclosure if it is in his power and interest. The tapes have been sealed by the Chief of Federal Police and could form the basis of a new charge of corruption should they be given to the judiciary (the Judge).

E - the Press

The local newspapers will disclose any information which they have if it is in their interest. Generally speaking they will be interested in a scandal which they report first. Disclosure, then is in their interest.

F - the Judge

The local judge has been very open in his support of a 'clean hands' campaign and will wish to be seen to be acting in a publicly stainless fashion.

G - the Opposition Party

The opposition would seek any opportunity to threaten the mayor's position, unless, of course, they were implicated.

Analysis procedure

The analysis follows the standard Powergraph analysis in two iterations. The initial problem as presented above is discussed and from this certain actions result, concerned primarily with the gathering of more data; in the analysis of the original situation, for example, the importance of differences in motivation between the three policemen appear. In the real life situation, of course, the Powergraph representation was not available, and so the second phase of the analysis is carried out using the retrospective knowledge of the consultant in question of the actual interactions between parties, rather than carrying out the actual investigations. Inevitably the same type of data emerged from the original, conventional advisory approach but the focusing process on the important characteristics of the situation took rather longer than using the Powergraph approach (Manunta, 1996b).

States of play

The following possible states of the situation were identified by direct elicitation (Manunta, 1996a) and emerged naturally from taking successive points of view of all the participants.

State 1: *Status Quo*

Here no disclosure has taken place, the information, whatever it is, remains inaccessible to the public. No blackmail or other threat is being made to the mayor.

State 2: *D threatens A*

Here a threat of disclosure has been received from D but no disclosure or resolution of that threat has yet been made. Depending on the demands made, no money has changed hands, and no agreement has been entered into to which responds to the threat. Conversely, although disclosure is threatened no actual release has been made.

State 3: *B threatens A*

A state exactly the same as state 2 but where the threatener is *B*, the chief of Local Police.

State 4: Disclosure has occurred without a threat

This state recognises that disclosure may occur because of some party who has no direct advantage to be gained from doing a deal with *A* (perhaps because *A* has no direct influence over that party's situation) but where disclosure could be to the benefit of the holder of the information.

State 5: A has responded to a threat and disclosure is prevented

Here *A* has relaxed the threat by responding appropriately to the threatener, agreeing that the threatener will not thereby disclose the information. The information is not in the public domain

State 6: A has responded to a threat but the information is disclosed

Here *A* has relaxed the threat (agreeing to the demands) but the information has come into the public domain (by whatever means).

Transitions

The next stage in the Powergraph process is to identify those transitions between the states of the previous section, together with the influences which govern those transitions. In particular the 'owner' of the transition must be identified, in the sense of the participant or participants who are in a position to bring that transition about. Equally important is the identification of the sustainment power at the state, being the ability of participants to maintain that state (should they wish to).

In the present example, the matrix of Table 57 resulted from these considerations. The elements of the matrix contain a 0 if the transition is not feasible and a logical (boolean) statement as to the 'owners' of the transition if it is feasible.

	To state 1	2	3	4	5	6
From state 1	A?	D	B	A+B+C+D+E	0	0
2	D+A?	A	0	0	D.A?	D+A?
3	B+A?	0	A	0	B.A?	B+A?
4	0	0	0	0	0	0
5	A(t)	0	0	0	A.B.D.E.G	A+B+D+G
6	0	0	0	A	0	A

Table 57: Feasibility matrix for Spanish Mayor case

Some of the entries contains symbol A?. This indicates that if *A* were to take specific actions then he could gain control of the transition, whereas taking no preparatory action would deny him influence in the transition. For example the transition from state 2 (where *D* has made a threat but disclosure has not yet taken place) back to the *status quo* (state 1) is under the control, apparently of *D* alone (since he and he alone could retract the threat). In point of fact *A* could have influence over him by means of sanctions outside the representation of the game which might induce *D* to view state 1 (the status quo) as being more desirable than leaving his threat on the table. To the extent that *A* can conceive of means of altering *D*'s freedom of action then he has control of the transition. For example *A* may be able to conceive of pressure which a third party (say the federal government) may be able to bring to bear upon *D* which would cause him to withdraw his threat.

Preference Ordering

Next we order the states for desirability from the view point of each of the participants. The table of preferences is shown as Table 58.

	A	B	C	D	E	F	G
state 1	1	1	3	3	3	2	3
2	3	2	3	2	3	3	5
3	2	4	3	4	3	3	5
4	5	5	1	5	2	3	1
5	4	3	3	1	3	3	4
6	6	5	2	5	1	1	2

Table 58: Preference ordering of participants - The Spanish Mayor case

Final network representation

Application of the Powergraph method described above leads to the final network of Figure 54. Before addressing the real-life considerations of Figure 50 there are certain structural points to be made.

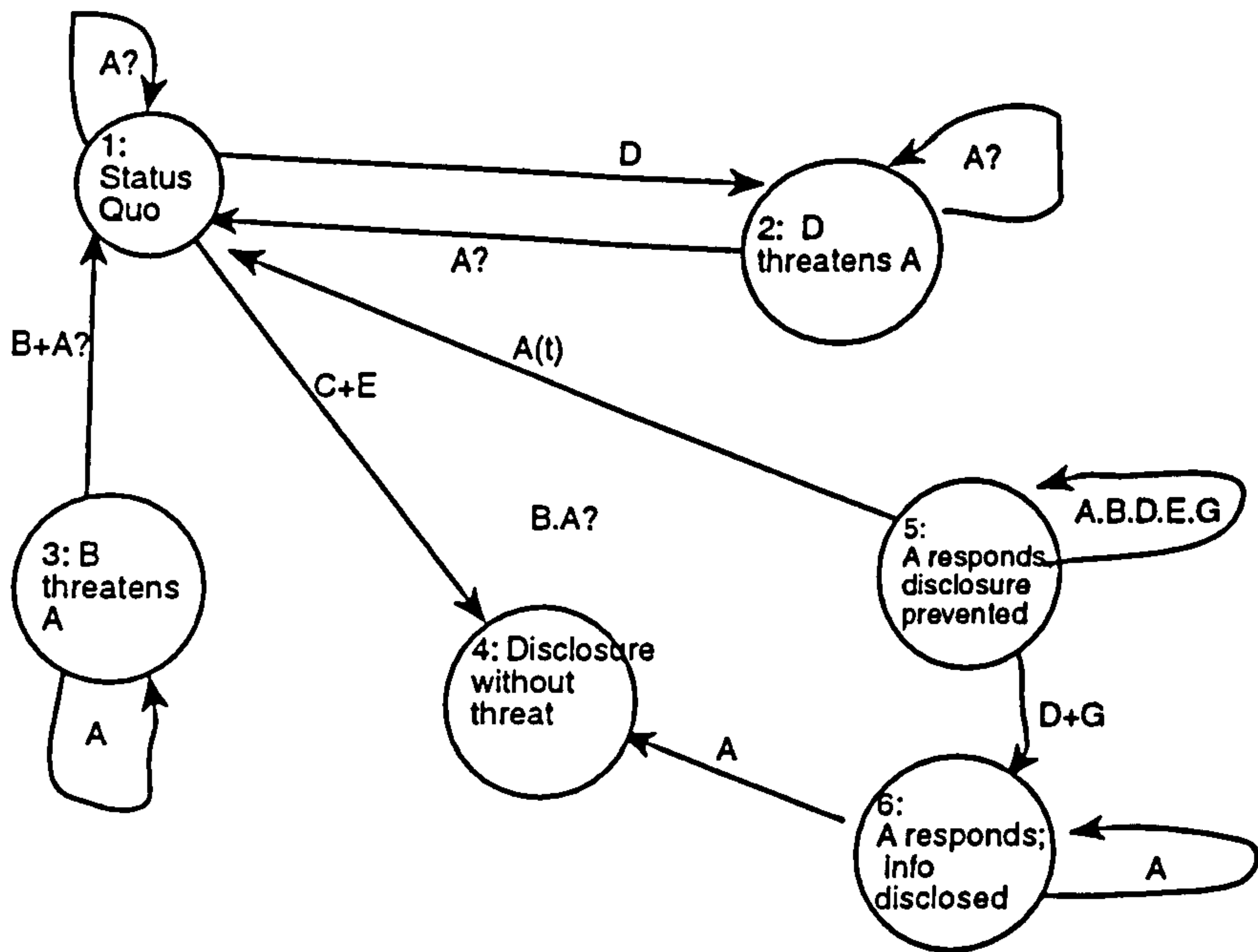


Figure 54: Final network of states - Spanish Mayor case

Firstly, state 1 has only two routes leading out of it, to state 2, where *D* makes a threat and a disclosure has not (yet?) been made, and to state 4 (where disclosure has been made without a threat being made).

Secondly, state 4 has no routes leading from it. In other words, if disclosure is made without threat, then there is no means of recovering the information. We also observe that if state 6

were reached (where after a threat is received and resolved, the information is nevertheless disclosed) there is at least a theoretical path back to state 4 (presumably the blackmailer is disarmed by the disclosure and other sources of pressure can be brought to bear on him, since he has no power now over the mayor).

State 5 is not accessed within this model, since it is not in *A*'s interests ever to pay the political ransom of a threat (since he judges he would lose power terminally in such an event anyway). However if *A* were to act irrationally and pay the ransom, the model indicates that possible improvement routes are back to 1 (by recovering influence over the blackmailer and recovering the money over a longer term campaign) or to 6 where (disastrously, *D* or a third party, *H* discloses the information anyway). The movement of *D* from 5 to 6 is an example of Rudyard Kipling's danegeld argument, whereby paying off a threatener results in a subsequent demand becoming more likely since the threatener's position is strengthened rather than weakened by the payment of a ransom (since *de facto* guilt on the part of the payer is implied)

What do we tell the Mayor? - conclusions from the analysis.

There are two development paths which should concern us. These are represented in the diagram by the transitions from state 1 (today) to states 2 and 4. These are respectively, threats to disclosure represented by the Chief of Federal Police (*D*) and by the three policemen and/or their advocate (*C+E*) respectively.

Threat by the Chief of Federal Police

The Chief of Federal Police may be involved in the plot or at least knowledgeable about the contents of the cassettes. He therefore represents a threat since it is in his advantage to threaten the Mayor, and he would be in control of that process. How then might we defend against such a move? There are a number of possibilities

a) sustainment power at state 1

There are ways in which *A* can defend state 1, the status quo. We might be

able to act in such a way as to dissuade *D* from threatening before the threat takes place, possibly by bringing influence to bear from the national level upon his situation. Although the Chief of Federal Police is a natural ally of the opposition party, to the extent that the Mayor's party will remain in power, they have a degree of control at the national level over the Chief of Federal Police's situation. In the diagram one can consider this as an attempt by *A* to readjust *D*'s view of state 2 being more attractive than state 1.

b) reversal of the move

There will be similar activities in which we can engage if *D* threatens. In particular we might be able to exercise influence over him with the national party, using the argument that as no blackmail has been paid, the Mayor is clearly innocent.

c) sustainment power at state 2

Once the Chief of Police (*D*) has made his threat there is no way in which he is going to follow through with the threat to disclose since it would be in his interest so to do. Perhaps the judgement is that the disclosure may be damaging to the Mayor, but the loss of power by the Chief of Federal Police in not having a threat with which to control the Mayor may be more attractive to The police chief. *A* can also attempt to recover state 1 by persuading *D* over a period of time to withdraw his threat.

Threat by the arrested policemen and their lawyer.

The second development, represented in the diagram by the transition from state 1 to state 4, is for either the three imprisoned policemen or the Press to release the information any way. This may happen in a number of very real ways. Firstly the attorney of the prisoners may advise them that a plea bargain may be achieved by giving up what they know of the surveillance which will inevitable result in confession. A defence against such a development might be to show loyalty in front of the judge in an attempt to assist the prisoners in

achieving a sympathetic hearing, threatening them then that if they attempted to disclose the information the Mayor would not only withdraw support, but would make sure that the three policemen went down with him. Critical in this is to prevent disclosure of the material to the Press.

Of primary importance is the observation that if state 4 were to materialise, the judge (*F*) alone has control over the situation.

Sensitivities

One would also make the observation that the only reason that the local Chief of Police is not a player in the diagram is because of our judgement that he would see state 3 as less desirable than state 1. This needs to be tested by judicious enquiry and sustained by the careful application of an argument that he has to be sure that the Mayor will be utterly brought down by the disclosure if the Chief of Local Police is so thoughtless as to betray him.

Conditional observations

If the affair were to follow the analysis above states 3, 5 or 6 could never materialise. In practice, however, the mayor may be tempted to pay the blackmail, thereby placing himself at state 5. He then has a more limited freedom of action. He could attempt to recover the status quo (recover the money by the exercise of some influence undeclared up until this stage), thereby inducing the transition from state 5 to state 1. Second, he could attempt to limit ten damage by defending state 5, but in order for state 5 to persist, all of *A*, *B*, *D*, *E* and *G* must act together - any of them could break the situation. Third, and worst for *A*, either the Chief of Federal Police, *D* or the local opposition party (*G*) could cause an investigation to be started anyway once the mayor's guilt is confirmed by his response to the threat. The mayor would lose everything unless he could cause the situation to recover to state 4 (where the information is disclosed but the threat of further action has been removed) but only by the exercise of unacceptable power or by an equally unpalatable loss of face or political power.

As far as state 3 (a threat by *B*), which should not arise, but which nevertheless could happen, *A* would appear to be in a fair position, in that he should be able to cause the situation to recover back to the *status quo* by persuading the chief of Local Police to withdraw his threat.

Overall conclusions from analysis

The mayor needs more information rather than immediate action. He needs, specifically, to determine the attitude of *D* towards *A*, since this will substantiate or otherwise the preference ordering of *D*. The mayor also needs to investigate the options available to him for the avoidance of path 1 > 4. This amounts to determining

a) how he can avoid being threatened by *D*

by reducing *D*'s motivation to threaten

by reducing *D*'s ability to threaten

b) how the mayor can minimise the damage if he is threatened.

The mayor also needs to investigate the position of the judge, since he is clearly a key player in some developments and that of the press, since, if they have the information in their possession, they will likely prove a dangerous disclosure route.

Commentary on actual situation

This section draws on the commentary provided by the consultant to the Mayor in real life and seeks to answer the questions raised by the analysis above, albeit in retrospect. It is quoted verbatim (Manunta, 1996c).

Following the suggestion coming from the exercise, more specific information has been researched, and obtained. Actions have been taken to reduce vulnerabilities, find arguments for negotiation, and for minimising those damages which are inevitable.

The attitude of the Chief of Federal Police [D] towards the Mayor [A] may be described as one of 'friendly neutrality'. The different reasons for this are: he depends on central government's directives (which ruling party is the same as of the Mayor), and is in this moment under attack for corruption. In this moment, the Federal Police is under attack for having spied politicians, ministers, even the Chief of the State, This is causing on high charges in Police, an enormous amount of criticism and personal pressures. He is a mature man, next to retirement, with a background of not getting involved into political-issues and local family interest. Until now, he has not officially informed the Judge about the existence of the tapes, which he considers irrelevant to the main case. More, he has not ordered all investigation on this specific issue. Therefore, we can assume that, if he is not obliged by third parties (the policemen, lawyer, the opposition, or the press) he will be quite happy to keeps things how they are. The investigation on the three policemen led to the conclusion that only one of the arrested policemen, [C1] was responsible for the illegal surveillance, and that probably the reason for that was not political, personal (actually, his family was in good relations with the mayor's) or intended to blackmail, but cautelative [sic], [a precautionary measure] in case of internal investigation).

The investigation of the Judge revealed him to have political ideas similar to the Mayor's, to have been at schools with his son (with whom he had remained in good relations), to be rather lazy and not too friend of the press. However, the Judge is considered an honest person, which, if [he] receives a formal communication of crime, will do his duty), with no regard of the consequences.

The above extract is from the informal considerations of the consultant in question in

respect of what issues the initial Powergraph analysis would have thrown up at the time if he had had it available. As a result of a 'role-playing' exercise on 17th June 1996, the next stage of the analysis, based on an extension of the above considerations was carried out (Manunta, 1996d).

Second iteration

Convergence of representation

The analysis of the previous section leads to an appreciation of the importance of two interest groups, namely the chief of federal police and the three policemen (and their legal adviser). The appreciation that it is these two groups who essentially control the situation allows a more refined analysis to take place. Before describing this next iteration of the method, it is worth discussing the relationship between the two analyses.

Firstly, one is tempted to ask why the more refined analysis was not included as a subset of the preliminary analysis. In the tactically exhaustive approach of Fraser and Hipel (op.cit.) and of Howard (1971), to the extent that the tactical choices were comprehended by the model, then it would indeed be the case that the situation would be completely covered by the model, but the effect of the Powergraph approach is different. It allows a greater understanding to be achieved by examination of the situation itself. It is again a question of the order in which the characterising elements are defined. In the conventional methods, tactics define outcomes, and the only outcomes admitted are those which emerge from tactical choice. Hence, if the tactical choices do not completely define the outcomes, then outcomes which are possibilities in the real world will not emerge since the tactical choice will not cover them. To put it another way, one has to decide whether the approach of participants is to decide what they and their opponents can do and then to accept the consequences, or to decide what they would wish and not wish to happen and then determine the likely behaviour thereby. Powergraph takes the latter approach.

Second, one must ask whether the preliminary analysis is wrong in any sense. Every analysis

is wrong; if it were not it would at the very least reflect a totally accurate representation of the real world in all its complexities; such would be indistinguishable from reality. The question, rather, is whether the inaccuracies of the model are materially important. There is a time component to this judgement in any real-time application. If we were dealing with a *post-facto* description of the situation then we could say with confidence that if the actions of the participants were not adequately described by the model in some material sense then the model would be defective. In particular, if the model appeared to judge the behaviour of a participant as irrational in the sense of not following a sensible set of rules towards an outcome which (it is judged) the participant in question would desire, then it would be defective. But there are many conditionals in such a criterion. We may be dealing with a participant whose ordering of outcomes is imperfectly known to us. We may be dealing with a participant who sees a different game space to ourselves, in which case we have a defect not in the analysis itself, but rather in our statement of the problem.

So much for the *post facto* descriptive use of such a model. Here the method is being used as a real-time advice tool, and the criteria for goodness are rather different. First, it is noted that the model is utilising information that is sporadic and defective; to the extent that the information is good, the model will tend to be good. Second, it is observed that the *raison d'être* of the model is different. Because of the recognition in the real-time problem that not everything is known and that ways must be found of knowing where to look for more and relevant information, the model is used as a sensemaking tool as well as a descriptive tool. Hence a lacuna in the solution can be accepted so long as the modelling leads us to fill that lacuna within the time scale appropriate to defend against the consequences of that imperfection in our reaction generated by the gaps in our understanding of the conflict situation. Third, the model is being used in a normative style rather than purely descriptively and so the need for timely advisory information is the important criterion rather than accuracy at any cost. Fourth, it is observed that in a real-time situation, it may be that none of the participants have a clear view of the entire game -space, and so a defect in the model may not have the consequences to be expected in a game of perfect information.

A new perception

The mayor sees the situation after the first analysis with a new understanding. First, he sees the importance of knowing who releases any information and whether or not an investigation has been started or not. The policemen are newly understood to be in different situations one from the other; one of them (subsequently called *C1*) has been found with the tapes; the others (*C2*) have no knowledge of the material, being simply small time criminals engaged in petty theft of computers.

The importance of the lawyer for the policemen is now seen to be significant.

In particular the mayor realises that it may be critically important whether he releases the information or whether a third party releases it. In the former case he could claim to have aided then investigation, in the latter his silence would almost certainly count against him.

A new analysis is needed to comprehend these new variables, and proceeds in a similar way to the first phase.

The new actors

Where possible the actors in this iteration have been given the same indicators as in the first iteration.

- A* - The mayor
- B* - The chief of local police
- C1*- The policeman who was found in possession of the tapes
- C2*- The other two policemen
- D* - The chief of federal police
- E* - The Press
- F* - The judge
- G* - The head of the local opposition party
- H* - The lawyer acting for *C1* and *C2*

The new states

The following states were defined. They recognise that the critical element at this stage of analysis is the question of who has released the information. It was judged that there was a significant difference between two states **'Information has been released'** and **'Information has been released by the mayor'**, for example.

- 1 Status Quo. No information has been released.
- 2 C1 releases information but no investigation has started
- 2+C1 releases information and a criminal investigation is started
- 3 G (the local opposition chief) releases information but no investigation has started.
- 3+as 3 with a criminal investigation in train
- 4 The Press releases information (without an investigation at this stage)
- 4+as 4 with an investigation
- 5 The lawyer releases information (no investigation)
- 5+The lawyer releases info (with a consequent investigation)
- 6 The mayor releases the information (no investigation)
- 6+As 6 with a criminal investigation
- 7 No information is released but an investigation has started.

Influences in transition

The following matrix (Table 59) summarises the influences and feasibility of transition in this second iteration.

	1	2	2+	3	3+	4	4+	5	5+	6	6+	7
1	A+B+(C1. G)+D+G	C1+(C1.H)	\	G	\	\	\	C1.C2.	\	A	\	A+B+D+E +G
2	\	F.D	F+D	\	\	\	\	\	\	\	\	\
2+	\	F.D	F+D	\	\	\	\	\	\	\	\	\
3	\	\	\	F.D	F+D	\	\	\	\	\	\	\
3+	\	\	\	F.D	F+D	\	\	\	\	\	\	\
4	\	\	\	\	\	F.D	F+D	\	\	\	\	\
4+	\	\	\	\	\	F.D	F+D	\	\	\	\	\
5	\	\	\	\	\	\	\	F.D	F+D	\	\	\
5+	\	\	\	\	\	\	\	F.D	F+D	\	\	\
6	\	\	\	\	\	\	\	\	\	F.D	F+D	\
6+	\	\	\	\	\	\	\	\	\	F.D	F+D	\
7	F+D	\	C1+(C1.H)	\	H	\	E	\	C1.C2.	\	A	F.(D+A)

Table 59: Transition matrix for Phase 2 of the Spanish Mayor problem.

Table 60 shows the preference ordering for the participants

	A	B	C1	C2	D	E	F	G	H
1	1	1	1	1	1	4	1	2	1
2	3	3	2	2	2	3	3	3	3
2+	5	4	3	3	3	3	3	4	3
3	3	2	3	2	2	3	2	3	3
3+	4	4	3	3	3	3	3	4	3
4	3	3	3	2	3	2	3	1	3
4+	6	4	3	3	4	1	3	4	3
5	3	3	2	2	2	3	2	4	2
5+	5	4	3	3	3	3	2	4	3
6	2	3	3	2	2	3	2	5	3
6+	4	4	3	3	3	3	3	7	3
7	3	4	4	3	4	4	3	6	4

Table 60: Showing the preference ordering for the participants of the states defined above

The resulting motivated power matrix is shown in Table 61 below.

		[111114121]	[332223333]	[543333343]	[323223332]	[443333343]	[333232313]	[643341343]	[332223242]	[543333342]	[233223352]	[443333373]	[344344463]
		1	2	2+	3	3+	4	4+	5	5+	6	6+	7
[111114121]	1	A+B+(C1. G)+D+G	\	\	\	\	\	\	\	\	\	\	E
[332223333]	2	\	F.D	f	\	\	\	\	\	\	\	\	\
[543333343]	2+	\	f.D	f+D	\	\	\	\	\	\	\	\	\
[323223332]	3	\	\	\	f.D	\	\	\	\	\	\	\	\
[443333343]	3+	\	\	\	f.D	f+D	\	\	\	\	\	\	\
[333232313]	4	\	\	\	\	\	f.D	f	\	\	\	\	\
[643341343]	4+	\	\	\	\	\	f.D	F+D	\	\	\	\	\
[332223242]	5	\	\	\	\	\	\	\	F.D	f	\	\	\
[543333342]	5+	\	\	\	\	\	\	\	f.D	F+D	\	\	\
[233223352]	6	\	\	\	\	\	\	\	\	\	F.D	F	\
[443333373]	6+	\	\	\	\	\	\	\	\	\	\	F+D	\
[344344463]	7	F+D	\	C1+(C1.H)	\	G	\	E	\	C1.C2.H	\	\	F.(D+A)

Table 61: Showing the motivated transition powers. Small case letters thus (f) show neutral motivation.

In Table 61 the judge (*F*) is frequently found to have neutral motivation, whereby he has no preference between two states. In order to indicate this his boolean indicator *F* is written thus (*f*). Such an indication allows for easy examination of those preference order changes which might induce a significant change in the outcome. It is easy to see here that if the judge were to be only slightly motivated against the transition it would not take place, but if he were only slightly motivated for the transition, then it would take place. It is a rudimentary sensitivity analysis tool.

Analysis of the Phase 2 final network

The directed graph of Figure 55 reflects that there is no one who has both the motivation and the ability (knowledge) to release the information. Thus it is likely that any investigation which starts will be because of a general suspicion by the authorities or indeed the Press that something is wrong. The mayor's efforts, then should be concentrated upon denying the Press any usable information (or indeed a *prima facie* case) for starting a public inquiry.

If the investigation starts, any one who has the information is motivated to release it. The question here is who has the information at that point.

Once the investigation has started (states 2+, 3+, 4+, 5+, 6+) it is the judge who is in control of the investigation (primarily) and the mayor has had the situation taken out of his hands. This places even more emphasis on preventing the transition from 1 > 7 in the first place. Alternatively, pressure may be brought to bear on the judge to dissuade him from allowing an investigation to go ahead. This could range from direct pressure to preparing him for the persuasion of the press by pre-briefing him so as not to believe the *prima facie* case of the Press.

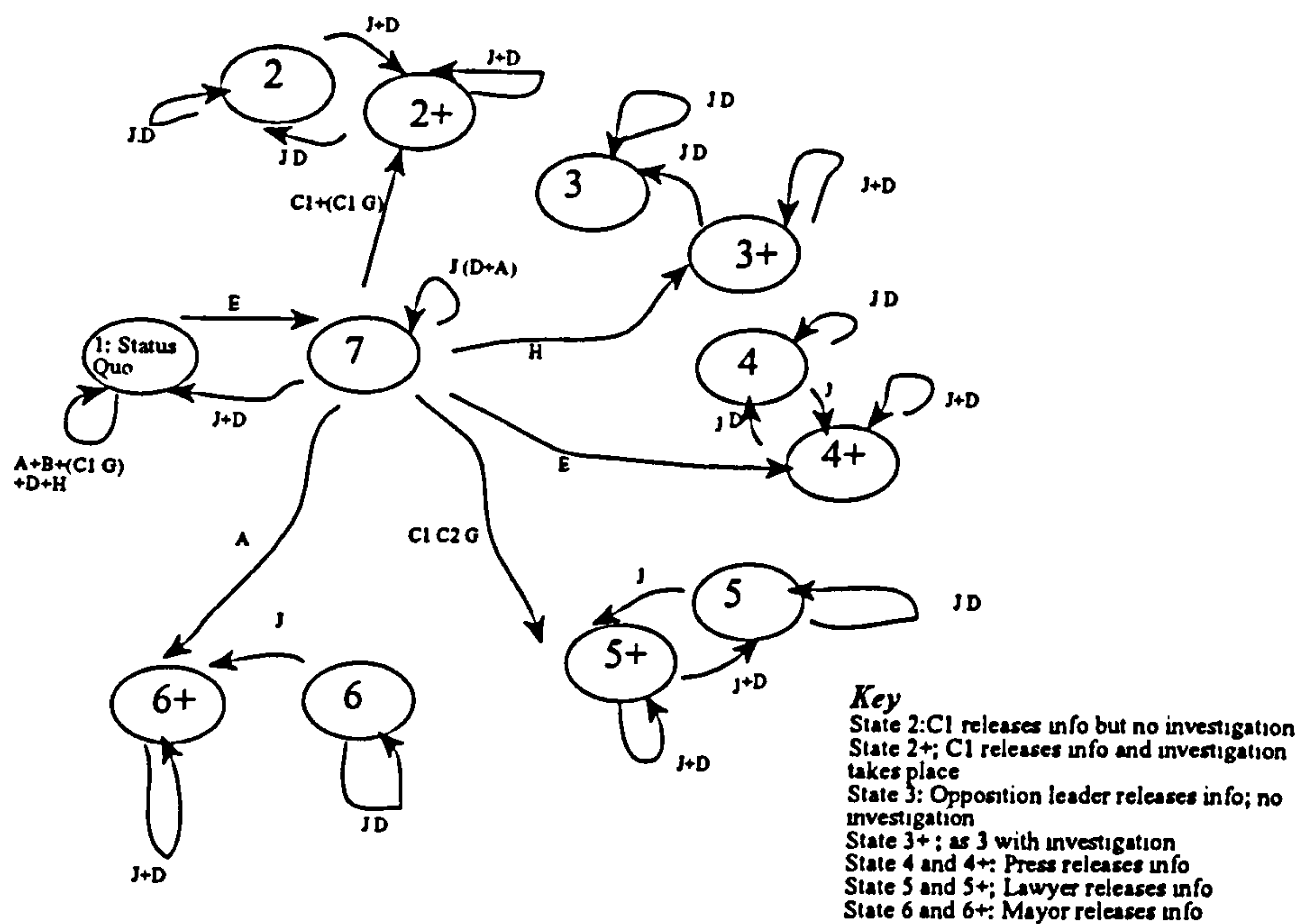


Figure 55: Final network of the Phase 2 analysis of The Spanish Mayor case

Subsequent Commentary by Consultant

The practical resolution of the problem eventually turned upon the age of the wiring discovered in the Mayor's office. The advisor's commentary is quoted verbatim (Manunta, 1996e):-

'A technical inspection conducted by the advisor in the Mayor's office has found evidence of an illegal connection to the Mayor's telephone lines in the PABX and of three different connection points to a tape recorder to three different lines, in the Mayor's office, in his secretary's office, and in a briefing room which is normally, but not only used by the opposition party. A similar number of non-utilised cables, leaving the above premises were equally found, who could have been exploited for listening or recording room conversations. A similar inspection conducted on the Mayor's premises and cars has revealed no evidence of present or past attacks. It was easy to tell from examining the wiring that it had been placed there more than one year before.

'All the information led to the following set of conclusions:

The age and place of illegal derivations suggested that the opposition could equally have been spied [upon]. This suggests that common interest in avoiding the disclosure of tapes could have been exploited with the opposition.

No deliberate intention of harming the Mayor could be identified.

C1 could be convinced, with some help, to stay quiet. [α]

In case of problems, the Mayor could claim to be the victim of a political plot. [β]

If necessary, the Mayor could make a preventative attack, giving the Judge the evidence of being attacked.' [γ]

These conclusions, α , β and γ above can be seen to be reflected in the final networks of Figures 54 and 55. Conclusion α bears directly on the original analysis and is in effect an implementation of the need to demotivate *C1* in moving from state 1 to state 4 in Figure 54. In this transition (marked with the boolean expression $C+E$) the influence of *E* is erroneous, as was subsequently determined, because the Press were not in fact in possession of the information which enabled them to control transition $1 > 4$.

Conclusion β is reflected in Figure 55 transition $7 > 4+$, where the Mayor himself is now in a position to release information to the Press, safe in the knowledge that the evidence gathered will safeguard him from prosecution, and that he can influence the Judge, in particular to see justice done and move the system to state 4 where the Mayor is safe from further investigation.

Conclusion γ is reflected also in Figure 55, where transition $7 > 6+$ has the direct effect of conclusion β above without the need to involve the Press *ab initio*.

Issues of practice for Powergraph

The case studies described throughout this work constitute a substantial body of practice in the use of Powergraph and certain valuable lessons emerge regarding its use. These are summarised here prior to an overall description in Chapter 10 of an *ex ante*, real-time case study which links together EFAR and Powergraph into a foveal game approach. Arguments for the justification of the elements and for the whole of the foveal game approach will be presented in the next chapter.

Intervention issues

As described above the intervention framework for the whole of this research was a participative enquiry framework. In practice the Powergraph procedure was found to be highly supportive of such an interactive enquiry approach. Because the stage products of the Powergraph procedure are essentially graphical in nature (either as tables or as diagrams) the respondent (in most cases a busy and powerful member of a large organisation) was able to see the developing structure as it emerged. The process is, therefore highly contributory, since, because the consultant and the respondent have the *lingua franca* of the tables and the directed graph, it becomes relatively easy to adopt an attitude of joint objective, both in terms of research and commercial aims.

The directed graph representation in particular lends itself to a joint approach. Because the analysis method is essentially one of interrogating a partially understood diagram, the conventions of which are found very easy to assimilate, an atmosphere of joint understanding (and sometimes of joint confusion) prevails. This of itself tends to tie together respondent and researcher in a common goal of understanding. The alliance is further strengthened by the realisation that the researcher is in no position to dictate the sensemaking of the process and requires, as much as does the respondent, a joint approach in order to progress.

The action planning stage is particularly supportive of a participative enquiry paradigm, since the very nature of driving out action plan elements, as seen in the *BAe Project Staffing*

case is an amalgam of semi-analytic results derived from the analysis procedure with heuristic and often subjective sensemaking on the part of the respondent.

In order to foster this participative approach in the use of Powergraph it is important not to declare the intent to adopt the objectives of the client organisation at too early a stage. It has been found that the stage products of Powergraph naturally set the agenda for a joint approach, and too overt an espousal of what can be seen as a presumptuous position of joint objectives is almost always counterproductive and unnecessary.

Preparatory Issues

It is generally considered a good approach in this type of research to come to some agreement about the question is being addressed (Guba and Lincoln, 1994). This research has indicated that while this is a good temporary structuring step it can also have the disadvantages that if it is defined and declared too rigidly the sensemaking product of Powergraph, which emerges gradually through the procedure, can be attenuated. It is far better in practice to agree with the respondent upon a working question, making the point that the objective of the Powergraph approach is as much to make sense of the situation in hand as it is to generate action planning.

Determining the participants is generally found to be straightforward. In none of the practical cases reported here (nor in the OSF case in the next chapter) was there any difficulty in deciding a working set of participants. Again, it is important to make statements to the effect that if a participant is forgotten the model can be amended later. While this is not strictly accurate it tends to avoid the difficulties of respondents trying to make sense of the whole problem in order to state it.

State generation

The process of state generation, as discussed in chapter 8 can be troublesome. Some respondents find it an intuitive and easy process to set down the likely outcome of a situation,

particularly if they have been involved in it for some time. This was certainly the case in *The Spanish Mayor* and *BAe's Project Staffing*. Frequently, however, a procedure is required and the top-down value based approach described above is an appropriate one. It has disadvantages, however, in practice, First, it is more time-consuming than an intuitive state generation process and second it can constrain thinking. One of the criticisms offered here of the existing Fraser and Hipel method (op. cit.) is that they generate a view of the future by considering tactical choices alone, and the top-down state generation process described can lead to a similar myopia, not through an over-concentration on what is seen as 'the tactical options' but through a fixation on the difficult judgements of the valuations placed by other players within the conflict. This needs to be guarded against in practice, but nevertheless the top-down method does produce a wider set of states than the bottom-up tactically-derived approach.

Subjectivity of Information

Respondents sometimes need reassuring that while the procedure may appear algorithmic, it is in fact a mobilisation of subjective information on their part. There is general suspicion of methods which appear to be too procedural.

Analysis of Directed Graph and Action Planning

The heart of the Powergraph is the process of deriving action planning (including intelligence gathering and sensemaking action) from the directed graph. There can be certain difficulties here. In particular, the presentation of a complex graph for analysis in one indigestible meal is a bad research option. The respondent frequently feels outpaced by this and the participative nature of the activity is lost when the researcher has to provide what can appear to be a ready-made analysis. The same care is required here as with any complex system representation, and in particular the technique of reduction, seen in Figure 52 of the *BAe Project Staffing* Case where only a subset of the path is shown, is important and effective. In practice there can be less difficulty than might perhaps be expected since the

process of identifying desirable options and paths is essentially a sensemaking one, and the respondent can be drawn along with the analysis procedure.

The analysis procedure is, in practice, very intuitive. The essential power-motivation algorithm is very easy to understand, and to a very great extent the value derived from analysis of the directed graph is one of ordering and structuring a plethora of subjective and partially understood data. Attempts to make the process too procedural fail because of this.

The analysis procedure does not drive out predictions where none can be made. An example of this is the identification of order of play issues where, on occasion there can be a temptation to look to the analytical procedure to give a single prediction of what will happen in the conflict. Some of the examples given above (*The Postage Stamp Crisis* is one) indicate that there are times when no single answer can be given because the future is essentially undetermined and depends on the micro-behaviour of participants to determine the macro-behaviour of the conflict. The essential unpredictability needs to be explained in advance to the respondent as a defensive measure.

Work Content

The Powergraph procedure is not a lengthy one. The *BAe Project Staffing* case took some three working days, including two meetings of about half a day each. Much of the work was done in direct consultation with the respondents. The *Spanish Mayor* case was different since it was performed using the consultant at the time as a dummy respondent. It took some 6 working days to complete for the two iterations. The *Battle for Trafalgar* took some 4 working days.

An appropriate technique is to limit time in contact with the respondent to those times when subjective input is critical; setting out the problem, defining the states and analysis of the directed graph are obvious ones. The process of generating the matrices can be done 'off-line' with occasional contact by telephone with the respondent.

Section V: A developed framework

Chapter 10:

A developed approach to conflict management

Case study - OSF's strategic future

Chapter 11:

Overall justification and critique

Justification and critique

compliance with the requirements of the process

compliance with criteria for justifiability

shortcomings and future work

Chapter 10: A developed approach to conflict management

Introduction

The previous case studies have addressed particular elements of the foveal game approach. In order to illustrate the overall performance of the foveal game approach (in contrast to its separate elements), this chapter describes a real-life, *ex ante* strategic analysis for Oxford Scientific Films Ltd., a medium sized media company experiencing restrictions to growth. The case study commences with a multi-futures analysis using EFAR, on which basis the owner started discussions to dispose of part of her company. The negotiations then developed, and a Powergraph analysis was required, which developed the detail surrounding one of the EFAR states. On the basis of this Powergraph analysis negotiations were continued and resulted in a successful resolution of the company's structural problems. The company was disposed of to a larger communications company.

This complete cycle of strategic planning, then, forms a part of the basis for the justification (in Chapter 11) of the foveal game approach and its elements.

This study has been previously published (Powell, 1997), from which this section draws. Certain textual changes have been made to fit the context of this present work

Case Background - OSF's Strategic Future

This section reports an actual analysis carried out at the request of a medium sized company, Oxford Scientific Films, Ltd., (OSF), based in Poland Street in Central London and with a site in Long Hanborough, some 60 miles outside London (Goldie-Morrison, 1995). The company produces advertising material of a specialist nature, primarily using natural history material and has a forbidding competitive environment, with a number of large companies, some the products of consolidation, some the result of entry from adjacent sectors, all under pressure in an increasing technical market. It presents essentially a niche marketing strategy based on a specific set of filming techniques, including time-lapse and extended

time photography (Anon, 1995).

OSF sits at a cross roads. The majority owner gained control some seven years ago and has engaged in a vigorous and successful streamlining programme including an effective organisational development programme based on the Investor in People standard. Now, however, she has come to an understanding that further growth, and possibly the viability of the company can only be secured by a strategic appraisal of importance of particular elements in the scene which she saw at the beginning of the present appraisal.

The two specific change issues were

a) the share holding status of the company.

The owner and MD holds some 53% of the shares of the company, which is not listed on the Stock Exchange. Another director holds a further 10% or so of the shares and the remainder is held by a number of partners. At the beginning of this appraisal the owner recognised (but did not openly declare) that a key decision to be made concerning the future of OSF was the determination of the consequences and possibilities of alternative share structures encompassing sale within and outwith the company and an outright sale. These options are declared in more detail below.

b) the organisational position of the company.

At the start of the exercise the company maintained two sites, one in Central London and one in a small town some 60 miles away. Elements of the operation, which consisted of two distinct entities, namely a film production capability and a still photograph library, were, in one way or another sited at both locations. The maintenance of a Central London site was expensive but essential for image and for adjacency to customers and the individuals who provided some of the key skills in production. Similarly, the mere existence of two sites produced a management overhead and an organisational communication difficulty because of the need to maintain a

motivational presence at the two sites and a degree of coherence between the two teams.

Linking the two issues were a number of secondary, but important factors which emerged in an introductory session during late November 1995 (Goldie-Morrison, 1995). Firstly, the availability of funds had always been an issue in OSF. Over and above the need for careful husbandry, the cash and revenue position did not produce, and seemed unlikely to produce in the near future, an excess of cash for development, either organisation reconfiguration or market development. Secondly, the competitive situation was seen to be changing. New technology in the form of computer aided design, production and image manipulation methods meant that there was a possibility that previously high entry barriers would be seen as lowered by new entrants into the sector, and moreover may undermine the basis on which OSF differentiated itself from the its competitors, both in the still image part of its business and in the (film) production side. The employment market in the sector was fairly volatile, so that a lack of expressed focus on the part of the company could well result in the short term loss of key technicians and creatives.

Study background and context

This case study was carried out at the invitation of the owner on the recommendation of another consultant, who had provided extensive advice on the organisational issues of OSF. An initial meeting at OSF's offices in Poland Street identified a number of ill-defined corporate issues in the mind of the owner. These included a changing competitive and technological environment, a sensitivity to the vulnerability of OSF to some of the very large competitors (such as the BBC). A particular concern was the feeling that OSF was constrained in its activities by virtue of its specialised niche position. In a sense, the owner had a model of OSF as a small animal which survived among larger beasts by remaining inconspicuous. She felt that this was both a risky ecological position and one that did not allow any opportunity for expression of the technical and creative skills of the company into commercial benefits. OSF had outgrown its specialised role.

The owner of OSF appeared frustrated and bored by her lack of freedom of manoeuvre. This showed itself in three ways. First was the ecological niche problem described above. Second was the inability of OSF to raise operational funds for expansion or even extensive product development within the existing corporate configuration. Third, she felt personally constrained because she had brought the company out of its initial poor financial state, had weathered a difficult recession period in the market, and was now left with a company which did not allow her personal expression of her clear competences as a manager.

In later interviews (Goldie-Morrison, 1996a,b,c), it became clear that the owner was a mixture of justified self-confidence mixed with patches of doubt. The development of OSF was not necessarily seen by her as coincident with her personal development, but she felt a great sense of loyalty to the other shareholders and therefore a solution to the owner's developmental problem would be more acceptable if it involved securing a future for OSF.

The approach adopted to the interventions was a participative one. This involved two activities. First, the owner had to be made sufficiently aware of the procedures involved in EFAR (and in subsequent stages of the foveal approach) such that she could take a full part in the multiple futures analysis. This took considerable time and consisted of talking the owner through a number of pilot multi-futures analyses (including a sanitised version of the case study *BAe's Alternate Naval Strategy* reported above). Second, a conscious attempt was made by the researcher to identify with the problems of OSF as a whole and of the owner as an individual. It soon became clear that the owner valued (probably disproportionately) the experience of the researcher in operating a unit of a PLC which, although it was small in terms of that PLC was some 5 times larger than OSF. This became a focus for a series of 'coaching' conversations about the approaches which could be taken in turning from a reactive 'ecological niche' approach to competitors to more conditioning, manipulative approach. A professional rapport rapidly built up, with a regular weekend telephone conversation being established at which a review of OSF's strategic situation was carried out, the owner clearly using the researcher as a confidant for matters which

could not be discussed with other consultants nor with her fellow director-shareholder.

Triangulation was available through the activities and confidentiality of the consultant who originally provoked the research. This consultant had been engaged for some two years in an organisational analysis of OSF and as a result had, to a large extent, both the confidence of the owner and the necessary background to offer a critique of the progressing multi-futures analysis.

Great care was taken from the second meeting on to use the appropriate vocabulary, referring to 'our' future, 'our' approach etcetera. The style of dress of OSF's senior (male) management team was noted and appropriated. This transference of allegiance was accepted without difficulty and it is a measure of the effectiveness of the attempted identification with the aims of OSF that it became natural for the researcher to be invited to all planning meetings between OSF and their financial and M & A consultants (Coopers and Lybrand) when these eventually became focused on the sale of the company (Goldie-Morrison, 1996d,e).

The intervention used EFAR to allow the owner to make sufficient sense of the future to allow strategic planning by producing a strategic network. In the first instance, the client presented her central problem as one of organisational design, in that she was concerned about the organisational viability of running a multi-site operation, but it soon became clear that the central issue was, in fact, the very existence of the company itself, and the effect of the EFAR study was to invoke an initiative to offer the company for sale. Central to this decision was an understanding achieved through the multi-futures approach that incremental development approaches were unlikely to offer sufficient security to the company, and that in order to realise the potential of the firm, a relationship with a parent which had greater funds available for development would be necessary. The resulting negotiation formed the key decision locale. Intelligence gained during the analysis and execution of detailed plans within that decision locale then informed the strategic network, as will be seen below.

Objectives

The initial discussion with the owner\MD during late November 1995 identified a need for a general review of the strategic future for OSF, concentrating on the issues identified above. It was quickly decided that the EFAR technique was to form the basis of the study. From the company's point of view, then, the objective was to throw some light on the effect of the interactions between share structure, organisation issues and related factors on the possible states in which OSF could find itself. (Powell, 1996)

Describing the Futures for OSF

In conversation with the owner of OSF a series of attributes were identified, following the EFAR methodology.

Table 62 shows the resultant set of characterising sectors together with the values which each could conceivably take. This is the final version of the table. The effect of deliberation over a period of time amended the table in detail from the initial draft. Close examination of the definitions of what *grow incrementally* means or what *single site improved comms* means resulted in a reduction of the number of values in the O sector from five to four and in some minor changes in wording.

These sectors and values emerged quite naturally from a semi-structured discussion about what is important to the client's business. Two structuring aids were used. Firstly, previous examples were offered to the client as a limited check list. There is a potential danger here that the client will simply choose what she sees someone else who 'runs a similar business' has chosen before. This was avoided by not showing an example from a similarly sized business. In practice this danger does not seem to appear, clients being generally keen to differentiate their businesses from previous users by pointing out different characterising values. Secondly, a set of previously successful 'key cue' questions were used at appropriate times in the discussion in order to ensure that appropriate coverage was achieved. Examples of these were, "*If you were telling your shareholders how things are going how would you structure your answer?*" and "*If you knew the levels of these attributes [characterising*

Sector Table For OSF Study (final version)

5	preferred or necessary partner	Preferred supplier				
4	willing cooperation of partners	Obtain security through niche position	Sell out	Improved perception - well differentiated	Timely, matched delivery	Single London site
3	status quo	Grow incrementally	Majority saleUV	status quo safe supplier if rather dated	status quo	Single site + London front office
2	Aggressive competitors	Survive	Replacement of minority shareholders	Reduced perception - poor quality, late etc.	Presumptuous marketing	Two sites with improved comms
1	Competitors specifically focused on OSF	Exit	Status quo	Last resort supplier	Unmatched to market	Two sites status quo
	C	A	S	E	D	F
	Competitive context	Extent of ambition	Shareholding	External Perception	Delivery capability	Organisational coherence
						Availability of funds

Table 62: Sectors and values for OSF strategic study

sectors] *do you feel that you would know what that future state consisted of?*". Use of these key-cue questions is a very effective way of establishing coverage and depth.

The Sectors and their values

C-Competitive Context

Although initially (Goldie-Morrison, 1995) the client was most concerned about the share holding and organisational structure of the company, it quickly became apparent (Goldie-Morrison, 1996a) that the competitive environment of OSF, although comfortable at the time, was a key characterising element of the future for the company. In particular, if the large competitors either viewed OSF as a threat or as a preferred (or even necessary) partner, their attention could be drawn to the company very specifically, and if that were the case, the power of the competitors in the market would be very great unless OSF had a niche position by virtue of a technological or quality edge or through an essentially unassailable customer base. Certainly the degree to which partners/competitors were friendly or hostile was considered to be important.

A- Extent of ambition

No expression was made of any ambition beyond the security which results from having a niche in the sense above. The present situation was characterised as incremental growth, with survival and exit as (clearly less desirable) options below. This limit in ambition was felt to be an expression of the implicit time horizon of this example, it being clear that the future forecast was to be centred on the next few months rather than the next decade.

S- Shareholding

The share structure of the company allowed four main positions to be

adopted, namely the *status quo*, where the client retained a controlling interest; a sale of a minority interest; the sale of a controlling interest; and, lastly, the sale of all of the assets of the company. Clearly one of the important issues surrounding such a sale would be the extent to which operational funds would become available either for organisational change or for more general market and product development. This will be seen later in the constraints defined between and among sector values.

E - External perception

This, the customer community's view of the quality of OSF's product, was included after observation of a previous client's sector value table (*BAe's Alternate Naval Strategy*, reported above). Clearly the perception will be related to actual performance in terms of lateness and poor quality, but may be subtly but importantly different. Thus the customer's perception of quality is only partly under the control of OSF; competitors' standard setting and benchmarking, for example, will affect the expectations of the customer.

D - Delivery capability

This was intended to indicate a wide definition of 'capability' encompassing both quality and delivery. In particular a point raised early in the discussion of the sector values was that of presumptuous marketing, in the sense of 'the customer gets what we offer because we know best'.

O - Organisation Coherence

The background for the importance of this sector is discussed above. Note here that the result is not necessarily better in the eyes of OSF as the sector value rises. In other words having only a central London office is not necessarily *per se* a better solution than having a regional office with a central London front office. It is necessary here to define rather carefully what is meant by the different sector values.

Sector value O1 - Two sites *status quo* is held to mean the present arrangement where two generally equally weighted sites are operated, with the owner/MD spending significant periods of time at both. Communication among employees at the two sites is good, but could be better. Significant and successful investment has been made in an Investors in People exercise to improve communication standards.

Sector value O2 - Two sites with improved comms means that further investment has been made in a way as yet undeclared which allows a tangible improvement on coherence of operation to be achieved. The main motivation for including this level of the sector O is to identify whether the physical location of the operation to one site is important when the balance of internal and external factors are taken into account.

Sector value O3 - Single site + London front office. Here a regional site is anticipated, possibly but not necessarily at the existing regional facility, together with an office in central London to allow interfacing with customers and freelance production staff who centre themselves there.

Sector value O4 - Single London site. This means that the only site operated is in central London. The financial consequences of such a move are considerable, and it was freely admitted that although this may be the most desirable from an operational point of view, financial considerations will probably militate against it except in a limited set of cases.

F - Availability of funds.

This was considered to mean the freedom of the organisation to expend resources either in the development of new products or techniques or in internal reorganisation.

Rejection of Infeasible Combinations

The next step in the EFAR process is to establish the connections between the sector values described and defined above by pairwise comparison of sector values. For example, the two sector values *Obtain security through niche position* and *Last resort supplier* would be incompatible. In the present analysis the understanding of the connection between operation funding, ambition and share structure required considerable discussion and clarification before the connections between the appropriate sector values could be defined.

Table 63 summarises the connections between the sector values. Each row consists of a single sector value in bold type and a list of all possible values of all the other sector values to its right. Some of these other sector values are replaced by '-', denoting that the combination is not considered feasible. Thus we observe that (in the column headed A), if Ambition has the value 1, then column S may only have the values 3 and 4, and the sector F can only have the values 1 and 2.

Annex D to this work contains notes on the table which will assist in determining the underlying connections of Table 63.

Resulting states

The matrix of Table 63, then, consists of a set of relations between the sectors so that any combination of the sector values of the attributes can be judged against Table 63 for feasibility. If any pair of sector values in that combination under examination does not appear in Table 63, then that combination as a whole is infeasible. In practice this is carried out by working backwards from the lower right hand entries of Table 63. The effect is the same; all the feasible combinations of values for the attributes CASEDOF can be determined.

Each combination of values for the set of sectors CASEDOF constitute a possible future. Without the feasibility statements of Table 63 we would have around 25000 possible futures (possible combinations of CASEDOF). After the rejection of infeasible combinations we are left with 66 feasible combinations or states.

Compliance Matrix for OSF study

Entries show which values are acceptable or feasible for each value in the left hand box.

E.g. For attribute C = 1, F can take only the values 1 2 or 3
For attribute D = 3, F can take only 2 or 3.

C	A	S	E	D	O	F
1	1 2 - -	1 2 3 4	- - - 4 5	- - 3 4	1 2 3 4 5	1 2 3 -
2	1 2 3 4	1 2 3 4	- - 3 4 5	- - 3 4	1 2 3 4 5	1 2 3 -
3	1 2 3 4	1 2 3 4	1 2 3 4 5	1 2 3 -	1 2 3 4 5	- 2 3 4
4	- 2 3 4	- - 3 4	- - 3 4 5	- - 3 4	1 2 3 4 5	- - 3 4
5	- - - 4	- - 3 4	- - - 4 5	- - - 4	1 2 3 4 5	- - 3 4
	1	- - 3 4	1 2 3 4 5	1 2 3 4	1 2 3 4	1 2 - -
	2	1 2 3 -	- - 3 - -	- - 3 4	1 2 - -	1 2 3 -
	3	1 2 3 -	- - 3 4 -	- - 3 4	- 2 3 4	- - 3 4
	4	1 2 3 -	- - - 4 5	- - - 4	- - 3 4	- - 3 4
		1	1 2 3 4 5	1 2 3 4	1 2 3 4	1 2 - -
		2	- - 3 4 5	- - 3 4	- 2 3 4	- 2 3 4
		3	- - 3 4 5	- 2 3 4	- 2 3 4	- - 3 4
		4	- - 3 4 5	- 2 3 4	1 2 3 4	- - 3 4
			1	1 2 - -	1 2 3 4	1 2 - -
			2	1 2 - -	1 2 3 4	1 2 - -
			3	- - 3 4	1 2 3 4	- 2 3 -
			4	- - 3 4	- 2 3 4	- - 3 4
			5	- - - 4	- 2 3 4	- - 3 4
				1	1 2 3 -	1 - - -
				2	1 2 3 -	1 2 - -
				3	1 2 3 4	- 2 3 -
				4	- 2 3 4	- - 3 4
					1	1 2 - -
					2	- 2 - -
					3	- - 3 4
					4	- - - 4

Table 63: Compatibility of sector values for OSF's strategic futures analysis

Clustering states

Sixty six states are difficult to hold in the mind, and, moreover, represent many possible situations where the specific future circumstances represented by the choice of values of CASEDO and F are, in an empirical sense, indistinguishable. For example, any set of futures characterised, say, by C being 1 (competitors focused strongly against OSF) would overshadow the detail in the other columns, and would tend to result in the perception of all such states being essentially the same. As another example, if funds are extremely scarce, states representing different market states will look the same to the client since no funds are available to act differently in one state than in another.

At this point then, the remaining 66 states are examined in an attempt to judge, using empirical criteria, whether any can be combined together.

The result of extensive examination of the states (Goldie-Morrison, 1996) is the list of combined states shown overleaf in Table 64. This table also contains a short note on each state to allow interpretation of the values of the CASEDOF attributes.

Transitions between states

The transition matrix

In order eventually to generate a strategic network, the feasibility of movement between states is examined. This is done by pairwise examination of the states of Table 64. Each pair of states is examined and the feasibility of moving between them in either direction is examined.

If this is done without assistance it is very tedious, since the number of transitions will be equal to the square of the number of states. A useful aid is to draw up a matrix of the total difference between states, adding up the differences between corresponding values of the attributes. We should then expect that states which are a long way from one another would be less likely to be linked by virtue of the transition between them being judged feasible by the client, but ultimately the criteria for the feasibility of transition lie entirely in the

Table 64: Resultant feasible states for OSF strategic futures analysis

Feasible Combinations for OSF Study grouped and reordered												
C A S E D O O F												
15	2	2	1	3	3	2	2					A high level of aggression from competition leads to a survival mode
37	3	2	1	3	3	2	2					Good performance in the face of aggressive competitors requires a survival approach
29+30	2	4	1	3.5	4	3	3					An excellent level of performance leads, in spite of a hostile competitive environment, to an expansionist strategy
16+38	2.5	2	2	3	3	2	2					Minority shareholding is changed. OSF has limited ambitions because of limits on funding. This also limits organizational development
17	2	2	2	3	3	3	3					Change in minority shareholding. Aggressive competition but funds are available for development. Existing performance standard maintained
18	2	2	2	3	4	3	3					As 17 but performance significantly improved to give better protection from competitors.
39	3	2	2	3	3	3	3					Minority shareholding changed. Fairly benign environment but performance only at today's level.
21+23	2	3	2	3	3	3	3					Moderate growth ambitions in the face of assertive competitors. OSF is supported by good cash flow.
22+23+24	2	3	2	3.5	3.5	3	3					As 21 but performance and perception have improved above today's standard. OSF is performing well against assertive competition. Ambition is for growth.
41+42	3	3	2	3.5	3	3	3					In spite of only moderate product performance OSF maintains an ambition for growth.
1+2+3+7+8+9	1.5	1	3	4.5	3.5	3	3					OSF is the target for highly aggressive competition. The company exits in the face of that competition, and a change takes place in the majority shareholding.
33+34	3	1	3	3.5	3	3	3					The existing management sells a majority shareholding while the competition remains dormant, and figures remain good.
19	2	2	3	3	3	3	3					The company decides to fight it out with the competition by raising extra funds through a majority share sale. Product performance is only moderate.
20	2	2	3	3	4	3	3					As 19 but product performance improved.
40+45	3	2	3	3	3	3	3					As 19 but with a neutral to positive competitive environment.
46+47	4	2	3	3	4	3	3.5					In the light of good product performance and positive agreements with competitors, a majority sale is carried out to generate funds for gradual development.
25+26+27+28	2	3	3	3.5	3.5	3	3					In the face of stiff competition the company decides to seek extra funding by a majority share sale so that it can sustain moderate growth ambitions, bolstered by a good product performance.
43+44	3	3	3	3.5	3	3	3					Good customer perceptions lead the company to seek extra funds for moderate growth by selling a majority shareholding
48	4	3	3	3	3	3	3					
49,51,52	4	3	3	3.5	3.5	3	3					Favourable approaches from partners leads to the conclusion that extra funds gained by a majority share sale might sustain a growth strategy.
50,53	4	3	3	3	4	3	4					A majority share sale produces extra funds for development which are used in organisational reconfiguration.
54	4	3	3	4	4	4	4					As 50,53 company relocates to central London.
31+32	2	4	3	4.5	4	3	3					A major share sale provokes an ambitious growth strategy in the face of determined competition.
55+56	4	4	3	4	4	3	3					Positive advances from competitors/partners after a majority share sale lead to the sustainment of a growth strategy. Organisational development is a significant part of the action plan.
61+64	5	4	3	4.5	4	3	3					OSF has become the preferred partner in the industry but requires funds from a majority share sale to sustain its growth plan.
62+63+65+66	5	4	3	4	4	3	4					As 61+ but generous funds are available for relocation, etc.
4+5+6+10+11+12+13+14	1	1	4	4	3	3	3					The strength of competition forces a sale in spite of good product performance..
35+36	3	1	4	3.5	3	3	3					In spite of good product performance the company cannot sustain its business and exits
58+59+57+60	4	3	4	4.5	3.5	3.5	3.5					The company is sold on advantageous terms with a good valuation due to its good relations with partners and its product performance.

business judgement of the informant. A table of distances between states can be found in Annex E of this work.

Table 65 shows the feasible transitions between states, with combined states being shown by the lowest number states followed by +.

	15	37	29	16	17	18	39	21	22	41	1+	33	19	20	40	46	25	43	48	49	50	54	31	55	61	62	4+	35	58		
			+	+				+	+	+		+			+	+	+	+										+	+		
15		1	0	1	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
37	1		0	1	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
29+	0	0		0	0	0	0	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	
16+	1	1	0		1	1	1	1	0	1	0	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
17	0	0	0	0		1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	
18	0	0	0	0	1		1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	
39	0	0	0	0	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	1	0	
21+	0	0	1	0	1	1	1		1	1	1	1	1	1	1	0	1	1	1	1	0	0	1	0	0	0	0	0	0	0	
22+	0	0	1	0	1	1	1	1		1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	0	0	0	0	1	0	
41+	0	0	1	0	1	1	1	1	1		0	1	1	0	1	0	1	1	1	1	1	0	0	1	0	0	0	0	1	0	
1+	0	0	0	0	1	1	1	1	1	0		1	1	1	0	0	1	0	0	0	0	0	1	0	0	0	0	1	1	0	
33+	0	0	0	0	1	1	1	1	1	1	1		1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	1	1	0	
19	0	0	0	0	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	0	1	0	0	0	0	1	1	0	
20	0	0	0	0	1	1	1	1	1	0	1	1	1		1	1	1	1	1	1	1	0	1	1	0	0	0	1	1	0	
40+	0	0	0	0	1	1	1	1	1	1	0	1	1	1		1	1	1	1	1	1	0	1	1	0	0	0	1	1	0	
46+	0	0	0	0	1	1	1	0	0	0	0	1	1	1	1		0	1	1	1	1	0	0	1	1	1	0	0	0	0	
25+	0	0	0	0	1	1	1	1	1	1	1	0	1	1	1	0		1	1	1	1	0	1	1	1	0	1	1	0	0	
43+	0	0	0	0	1	0	1	1	1	1	0	1	1	1	1	1	1		1	1	1	0	1	1	1	0	0	0	1	0	
48	0	0	0	0	1	0	1	1	1	1	0	1	1	1	1	1	1	1		1	1	0	0	1	1	1	0	1	0	0	
49	0	0	0	0	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1		1	0	1	1	1	1	0	1	0	0	
50	0	0	0	0	0	0	1	0	1	1	0	0	1	1	1	1	1	1	1	1		0	0	1	0	1	0	0	0	0	
54	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	1	1		0	1	1	1	0	0	0	1	
31	0	0	0	0	0	1	0	1	1	0	1	0	1	1	1	0	1	1	0	1	0	0		1	1	0	0	0	0	0	
55	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	1	1	1	1		1	1	0	0	0	0	0	
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	1	1		1	0	0	0	0	
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	0	1	1		0	0	0	0	
4+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	0	0	
35+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		0	
58+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0

Table 65: Feasibility of transitions between states in OSF strategic futures analysis

What does this table represent? The possible futures are defined by combinations of choices from the attributes CASEDOF. Large numbers of these possible combinations were then rejected by considering whether pairs of sector values are compatible. Table 65 shows a 1 where a transition is adjudged feasible by the client and a 0 where such a transition is deemed impossible. Table 65 thus represents a linked set of states which if shown graphically would be a map. Locations, rather than being physical towns or cities are states of the

future. Some of these states are desirable some are less so. Some transitions are within our power to control, some are under the control of another 'player'.

Note that some transitions are feasible in one direction but not in the other. For example, the transit from state 37 to state 33+ is feasible but not from 33+ to 37. The underlying logic is easy to see, since moving from 37 to 33+ involves selling a majority of shares which, in real life would not be easily bought back.

Graphical interpretation

The structure of Table 65 is not easy for the unpractised eye to absorb, and so a number of equivalent representations were created which represent the states as localities on a map and the transitions as lines linking them.

Here, the states have been ordered into categories of share structure, so that all states representing the *status quo* are in one group, all states representing a wholesale share sell are in another, etcetera. This tends to group the states into clusters which represent the freedom of action under that assumption (of share structure). This is shown in Figure 56, the basic topology of the analysis, which is discussed in detail below. Figure 57 gives a key to the states for easy reference.

Figures 58 and 59 show, respectively, the source states (from which transition can be made), and the receiver states (to which transition can be made). These were particularly useful reductions of the detail of Table 65 for this particular informant. Further detailed reference can always be made to the transition matrix of Table 65. Lastly, for ease of reference, two further figures (figs 60 and 61) indicate high competition states and states where particular organisational configurations pertain.

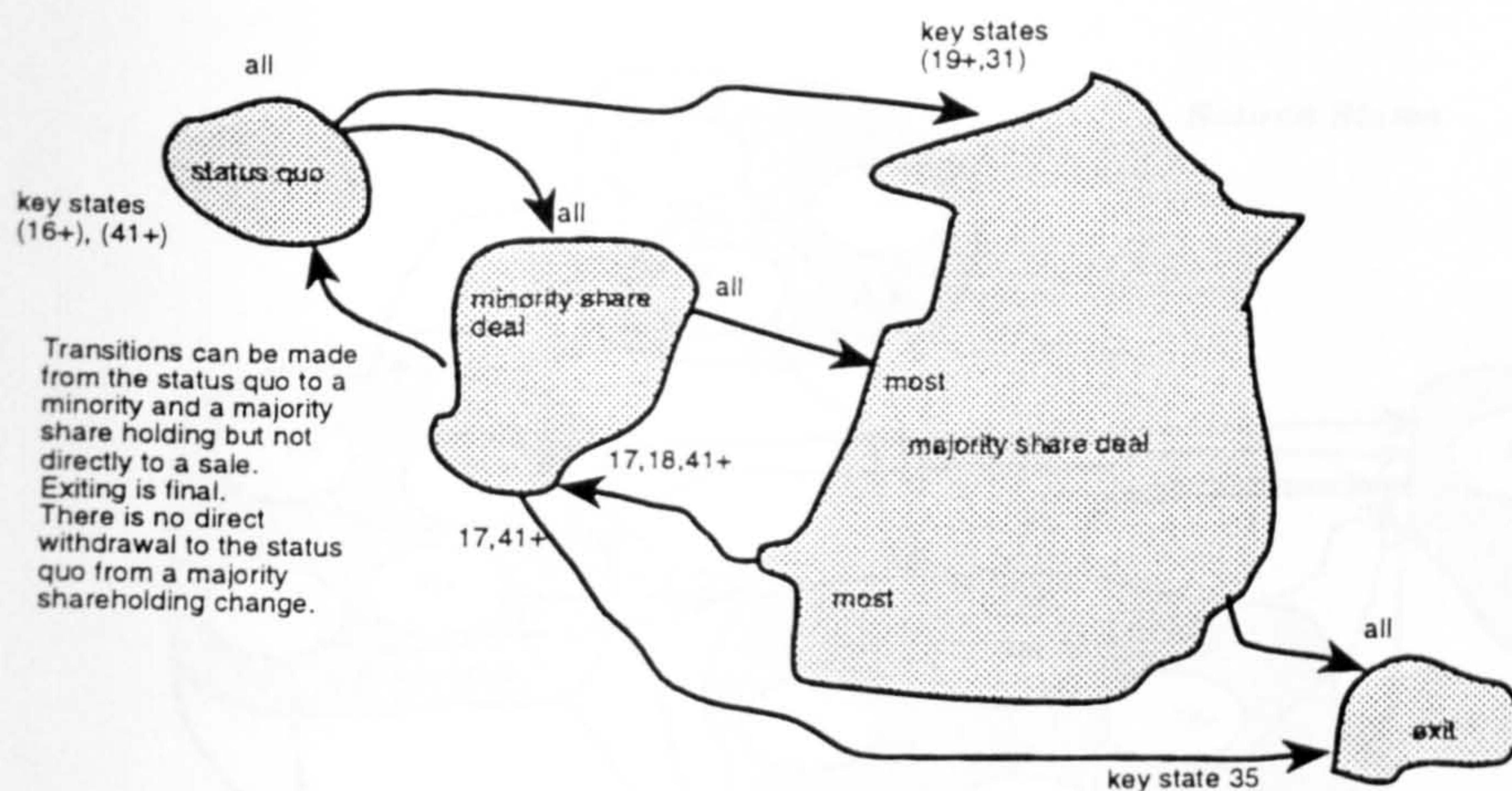


Fig 56: Summary strategic graph for the OSF strategic futures analysis. (Each large (clustered) state contains a number of sub-states. Shapes of clusters are arbitrary, but size reflects the number of included states.)

Brief Descriptions of States

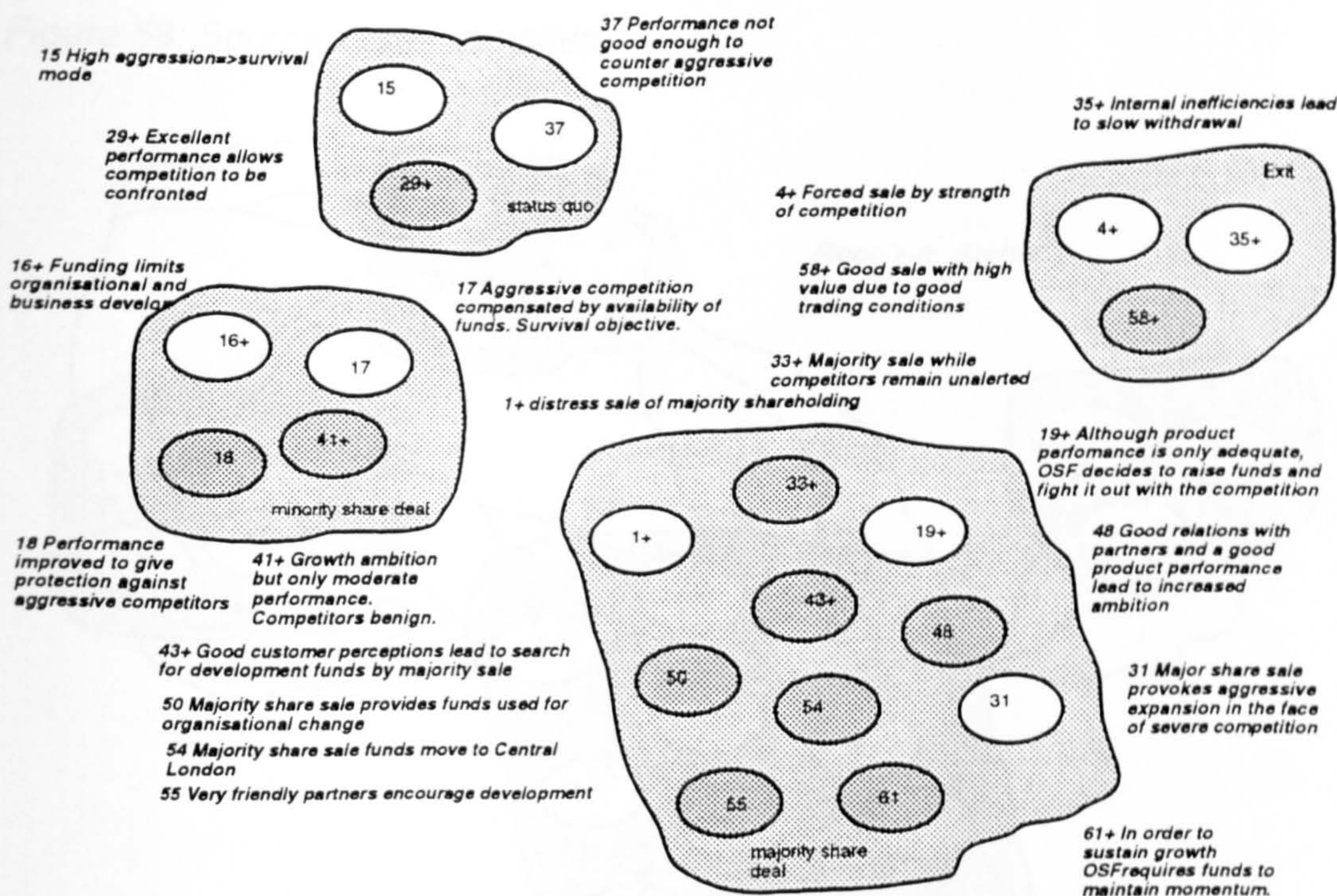


Fig 57: Sub-states within clustered states of Figure 56.

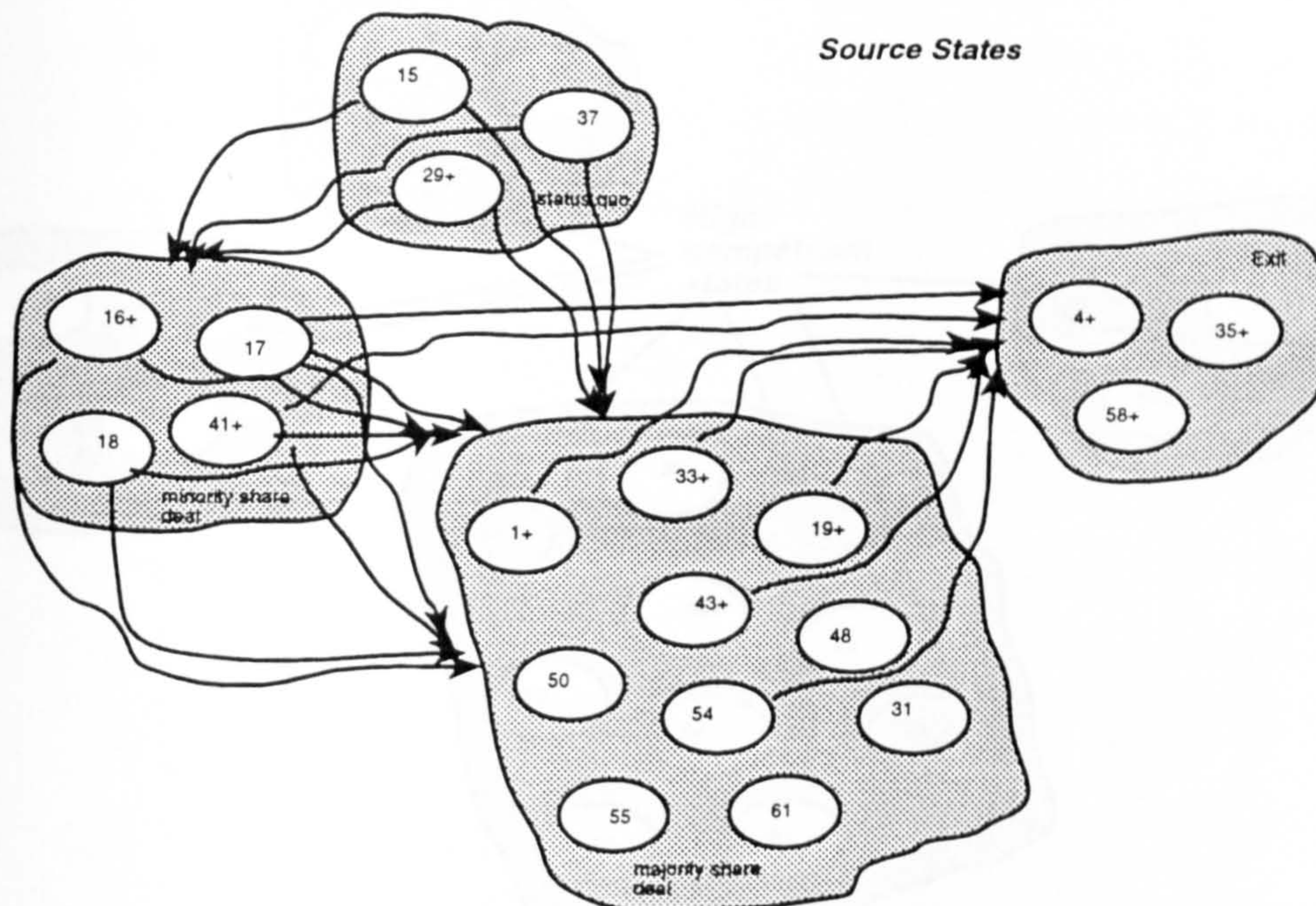


Figure 58: Source states identified

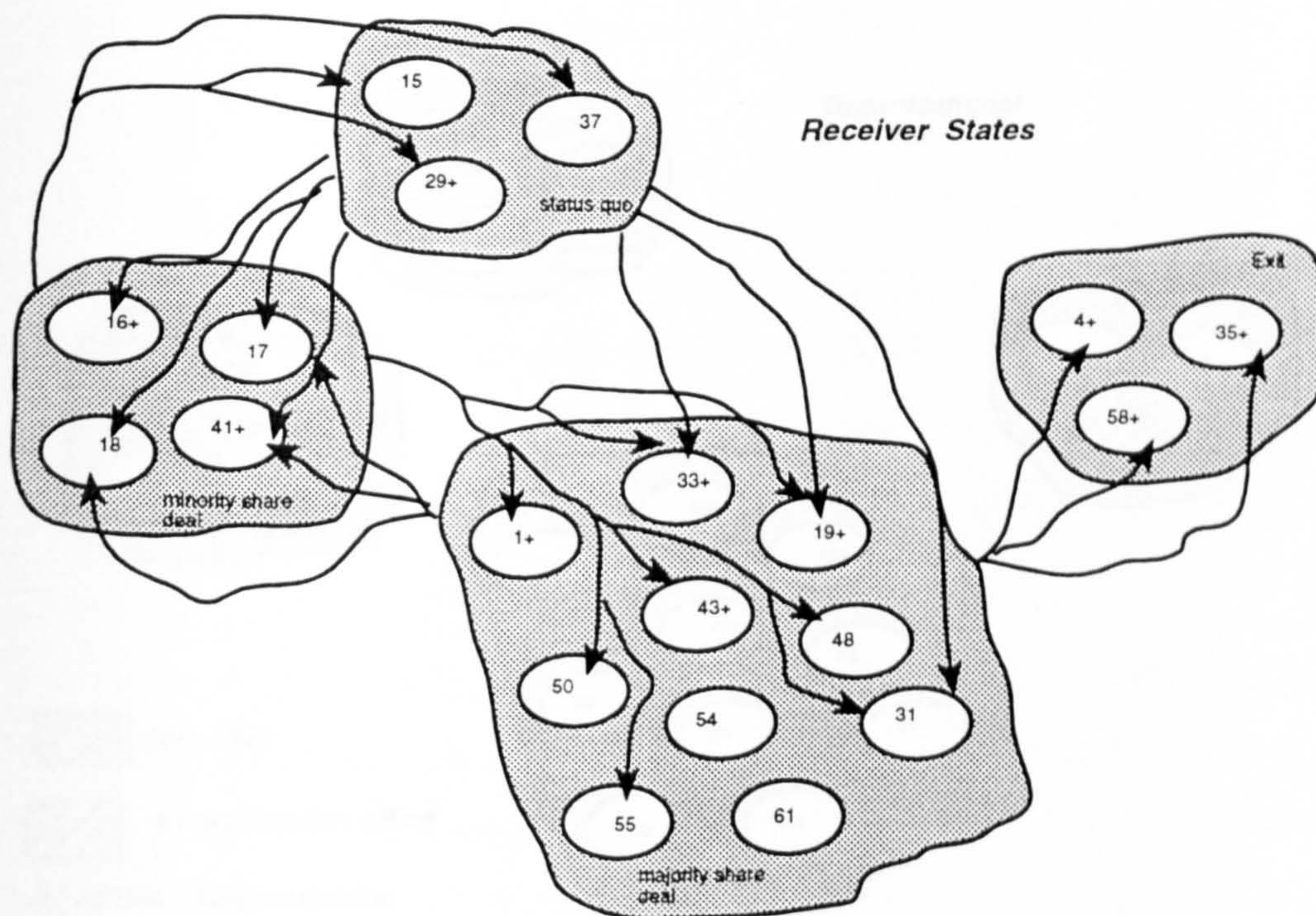


Fig 59: Showing the receiver states for the OSF strategic analysis

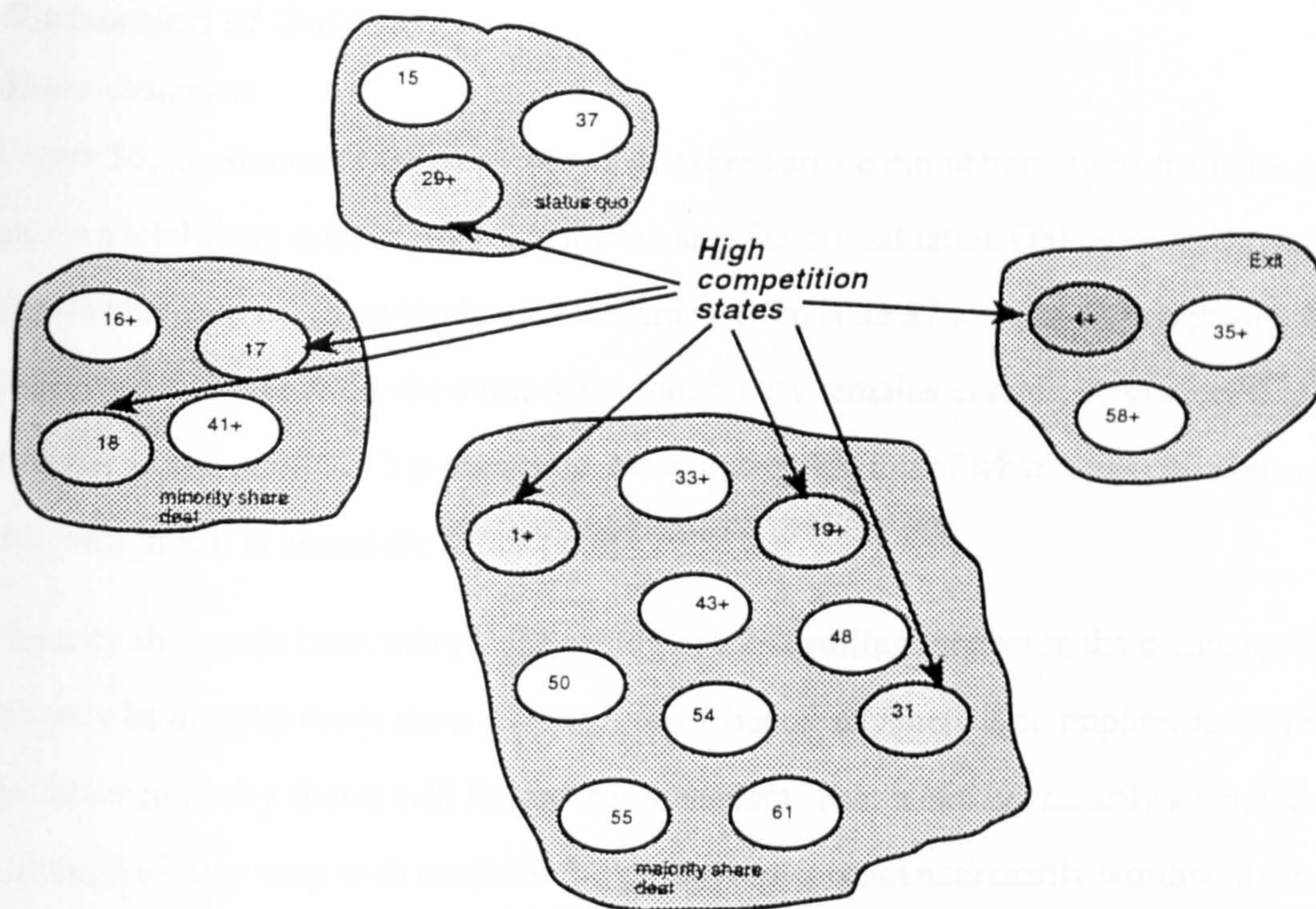


Figure 60: States of high competition in OSF strategic analysis

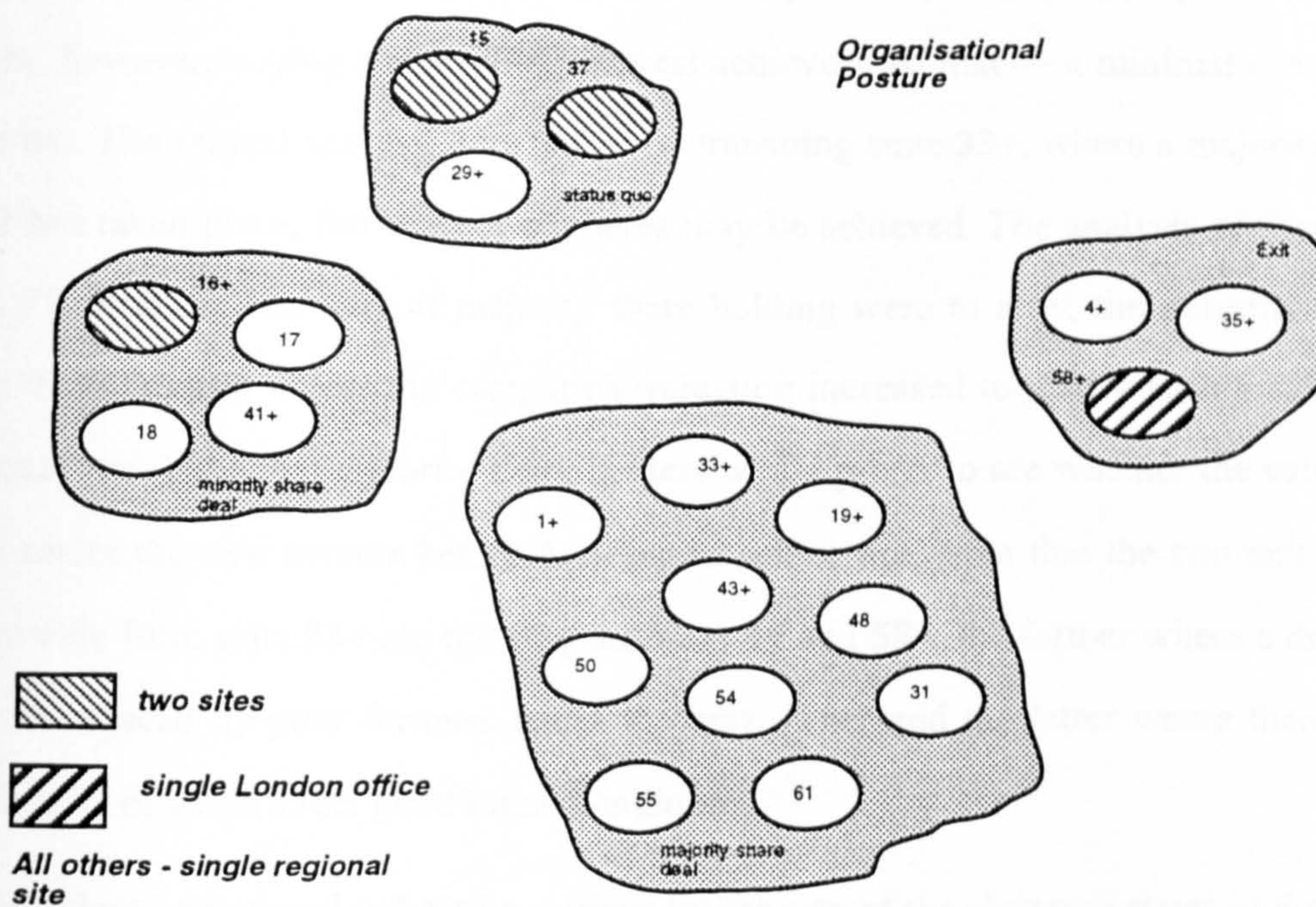


Figure 61: States differentiated by organisational posture

Discussion of Output

Share structure

Figure 56, the summary topology shows that there are no direct transitions from the *status quo* to a total share sale; in order to achieve a satisfactory valuation OSF must move through intermediate states. In particular, the transition from state 37 to state 33+ (representing a majority share sale while the competitor community remains essentially unalerted to any major redirection of OSF) is important. Some interpretation of what 'majority share sale' and 'exit' mean is necessary at this point.

Majority share sale here refers to the selling of a controlling interest in the company. That can only be done by the present majority owner, but clearly there is an implicit assumption that other minority shares will follow that precedent. That is not necessarily so, however. Although a buyer may wish to obtain full ownership, it is not necessarily worthwhile to go beyond a narrow controlling interest. If the intent is totally to absorb the activity of OSF into another operation without having to pander to the (admittedly emasculated) interests of the minority share holders, then a full and complete buy may be appropriate. In many cases, however, buying a controlling interest achieves just that — a minimal controlling interest. The critical analysis here is that by transiting state 33+, where a majority share deal has taken place, full transfer of shares may be achieved. The analysis of figures 56 and 57 indicates that even if majority share-holding were to alter, the minority shares would not be sold unless the company's valuation increased to justify such a sale. The rationale could be that minority share holders would prefer to see whether the valuation rose under the new owners before deciding to sell or not. Note that the two exit states accessible from state 33+ are the very different 4+ and 58+, the former where a distress sale is induced by poor fortunes under the new owner and the latter where there is a realisation of value under good future conditions.

A very clear operational indication is given by the size of the clustered states in the four different share holding conditions. Note the size of the majority share deal set (reflecting in Figure 56 the number of states in the set) compared with either the exit or the *status quo*

condition. Since the states in the set are essentially simply connected, each being reachable from the others, the size of the cluster determines the number of states which can be accessed from any member. The size of the set then indicates the freedom of action in that share ownership state. That is not to say that it is necessarily OSF which has that freedom of action; other agents will have some degree of control over movement between at least some of the states. Analysis of who controls the different transitions and in what manner is necessary to determine the 'owner' of a transition is a process which is at the heart of the next ongoing stage of the analysis of which EFAR is the precursor. Here, however, the freedom of action refers to the complexity and the opportunities of doing business under that share ownership condition.

Why should this be so? It would appear that the determining characteristic is the additional operational funding which would become available if shares were realised. This operational funding then allows competitors to be confronted in the market or organisational reorganisation to take place. Each in turn alters the market state, either directly (through increased market share in the first case) or indirectly (through increased efficiency in the second case). This in turn affects the ability of OSF to generate cash and so on. Of course, some transitions within the diagram indicate the undesirable consequences of OSF failing to apply funds effectively, so that a more ambitious product position might result in a downturn in customer perception and delivery capability rather than an improvement in the market state. State 19+ is an example of such a deteriorated state and indicates the need to maintain product effectiveness even with an influx of operating funds.

Organisational Position

From the connectivities expressed in the diagrams it can be seen that the initial assumption made that a single central London office would be an unlikely outcome was correct. The indications are that the high cost of such an organisational solution would be achievable only with what amounted to a total share sell. Moreover the effect of such a move would

be likely to sensitize competitors to focus on OSF. If the product quality and cost base can be kept at high and low levels respectively, then there is the opportunity for OSF to move into the highly desirable state where the competitors become willing partners, OSF having some technology or technical advantage which makes it a highly advantageous partner for the bigger companies. The big disadvantage, it is surmised, is that moving to a London office would involve of itself a high expenditure in capital and upkeep terms, and would, additionally, require a significant investment to improve the product quality and differentiation and company image in order to bring about such a fundamental change in the attitudes of present competitors. It is not impossible, however, and one can imagine that with a transition strategy of 37 to 33 to 58+ discussed above, such a development path is feasible on the ground.

What would that entail? Firstly a majority share deal would have to be negotiated without initially exciting the competitors. This would release funds to allow either a central London consolidation or a major product investment (the analysis does not distinguish between the two). This in turn would then allow the necessary transformation to take place in the relations between the competitors and OSF. There are dangers, of course. If the majority share holding releases funds which are not invested wisely in product improvement/differentiation, then no amount of relocation will suffice to bring about state 58+. Instead the company will devolve to the unsatisfactory state of 4+, as its product quality and external relations decline. The analysis would seem to indicate that OSF has the choice between a number of states where a single regional office is established and a majority share deal is struck, releasing funds to allow exploitation of the space around states 43+, 54 etcetera and, on the other hand, a higher risk development where a full sale is induced together with a major reassessment of the ambitions of the company.

The analysis does not at this stage take into account the ambitions and resources of any buyer. It could be that a sale of itself implies a distinct change in direction, although at this level of analysis it would not seem likely that any of the competitors themselves would be

interested in a buy. Far more likely would be the arrival of a buyer interested itself in transition to a more equal position with respect to the existing competitors.

The *status quo* organisational position is clearly untenable. The present arrangement is unlikely to lead to a sufficiently large change in the product quality or (perhaps more importantly) the perception of OSF as a high quality company as to allow a sea-change in the competitive and financial environment to be induced. Even two sites with improved communications appears only in the lower end of the desirable outcomes. The analysis shows the preconceptions implicit in the constraint matrix of Table 63 that if money were available two sites would not be the answer to the problem; there is a predilection towards a 'clean' solution which implies essentially a single site operation. But such a reconfiguration implies an influx of funds.

General

It is quite clear that in addition to the immediate and critical share ownership/funding issue the most important focus must be product quality and image. While this is always an important factor in the future of any selling organisation, here it is an important factor in opening doorways to states of the future which otherwise would be closed. In particular it bears directly on the share value of the company and on the likelihood of good relations obtaining between OSF and competitors/partners. The only incremental route for the company is in excellence in product performance (state 29+, allowing competitors to be taken on in the marketplace direct) or in being fortunate to meet a competitive environment which is just benign enough to allow cash to be generated with only a moderate product performance. This latter would not seem to be a particularly likely scenario.

The minority share deal option in this context does not seem to present any states which give great comfort for the future.

The position at the end of the EFAR analysis

The result of the EFAR analysis reported above confirmed the hidden view of the owner/MD that drastic structural action was required. In a series of conversations (Goldie-Morrison, 1996b, 1996c, 1996d) she developed the idea that the only way ahead for the company was to seek at the very least a substantial share sale. It was clear that she had slightly different objectives from the company *per se*. Her own motivations were for freedom of (personal) managerial action; the company's objective was for medium term survival in the face of the increasingly severe competitive environment. In point of fact these two objectives were not incompatible, and the initial reaction of the owner/MD was to invoke the assistance of Coopers & Lybrand, the management services consultants, in order to trawl the industry for suitable candidates for a major buy-in.

The company at this point was considered to be at state 37; two sites were being operated, the competition were unalerted to the prospect of any change of share ownership, and yet OSF was unable to confront the competitors effectively because of a lack of operational funds.

The owner considered two development paths. The first, from state 37 to state 29+, where the company's performance was improved under the existing exigencies of funding so that OSF's performance before the competition was substantially improved, was addressed by an audit of the capabilities of the company. Certain minor adjustments were made, to do with the efficiency of the operation, but the short term conclusion was that there was no speedy way to improve the efficiency of the operation.

The second approach was to start a trawl for likely buyers (Anon, 1996). Shortly after the analysis reported here, the company, using Coopers and Lybrand as agents, began discussions with a number of large competitors with a view to selling a majority of shares. This represents the transition from state 37 to state 33+. At this point in the development of the situation there was little suspicion that OSF was engaged in any conflict as such — a situation had been identified which required response, and that response was to be an

attempt to sell a majority of the shares. Soon, however, the complex negotiation began to become difficult and more conflictual and the analysis of that decision locale commenced (Goldie-Morrison, 1996e).

The negotiation analysis

At the date of the analysis reported here (10th March 1996e), OSF is in the middle of discussions regarding its ownership. There are four interested parties who remain acceptable *prima facie* to OSF. These are

Dorling Kindersley	(DK)
Circle Communications	(CC)
Harmsworth Media (part of Associated Newspapers)	(HM)
Just Results	(JR)
(an independent company partly owned by Bob Morton, who holds a 30% investment)	

The last of these represents a vehicle for conversation between OSF and Bob Morton, and in fact is merely a vector for a possible minority share sale to Morton. Thus the first three represent genuine prospective owners, and the last a means of bringing operation funds into OSF.

We are at the second round of bidding. In the first round CC, DK and HM effectively bid similar amounts, although the DK offer was couched in less favourable terms because of complexity of financial instruments and limited liquidity for the principals of OSF. In the second round, after a ‘best and final’ was requested by OSF’s accountants, the following responses were received.

CC offered the best cash amount (£3.75m), with good liquidity and a favourable salary package for the OSF principals. It is felt that there is a good cultural and operational fit with CC, and it is at the moment, the most likely of the bidders to offer the most acceptable package.

DK offered a similar amount on paper, but with poor liquidity. Much of the offer consisted of loan paper, and shares, with the result that the cash offer was a mere £800k. Moreover the management of OSF were being offered what the felt was a sweetener, in order that they would be prepared to pay less than appropriate attention to the interests of OSF's existing minority shareholders. Additionally, the salary offered for the OSF managers was insufficient bordering on derisory. Lastly, in discussions with DK, the approach of the company to confidentiality in particular and to management issues in general was felt not to be of the highest standards.

HM Offered substantially less (£2.6m effectively) but still offers room for negotiation.

JR Offered effectively £4m, but this represents a dummy bid, in that the real offer is for a near *pro rata* minority buy-in by Morton.

In terms of development opportunities, the bidders are very different. After a initial meeting of minds, the DK organisation is seen to be 'a large cottage industry' with insufficient shape and focus to allow full rein to the talents of the OSF management. More worryingly, the place of OSF in the DK organisation would place the OSF top management in an inappropriately junior peer group. CC presents a different picture; OSF would represent one quarter of the assets of the company, and would provide significant opportunity for development for the OSF management and indeed for OSF itself. Moreover the attitude of CC to the deal itself has been of the highest levels of integrity and professionalism. HM present the prospect of OSF being a small twig on a large organisational tree.

Problem statement

The predilection of OSF is to accept (eventually) a deal with either CC or HM as an outright sale, retaining the present management on a salaried basis or to accept an investment by Morton (JR) in order to raise operational funds for development. This would represent

another failure to acquire by DK, which may then withdraw goodwill from OSF. This might be damaging because of an attractive business proposition which OSF and DK are preparing (known as 'the series') which could represent a line of revenue approaching £2m per annum.

The task is to indicate what developments might take place in this situation, bearing in mind the motivations and influence of the players, and thence to offer proposals as to how more desired outcomes could be promoted, while managing the consequence to OSF's business of a possible loss of goodwill on the part of a useful business partner.

Participants

O	OSF
C	Circle Communications
H	Harmsworth Media
M	Morton
D	Dorling Kindersley

States

The following states of play are defined

- SQ Status quo; no agreement has been reached with any party. 'The series' remains in place with DK.
- 1 Stalemate; no agreement has been reached and discussions have ceased with all parties. DK goodwill remains good.
- 2 Freeze-out; no agreement has been reached and discussions have ceased. DK has withdrawn substantial goodwill because of OSF's lack of cooperation
- 3 Agreement has been reached with DK
- 4 Agreement has been reached with CC or HM. DK remains cooperative at the operational level.

- 5 Agreement has been reached with CC or HM. DK is chilly; they continue to buy footage, but ‘the series’ opportunity has to be pursued with another party.
- 6 Agreement has been reached with CC or HM. DK removes goodwill.
- 7 Agreement is reached with Morton on a minority share deal. DK are cooperative
- 8 Agreement is reached with Morton. DK are chilly.
- 9 Agreement is reached with Morton. DK withdraw goodwill.

Transition Matrix

The following matrix (Table 66) gives the influences operating over the transitions.

	<i>SQ</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>
<i>SQ</i>	Φ	<i>O.D</i>	<i>O.D</i>	<i>O.D</i>	<i>O.C</i>	<i>O.C.D</i>	<i>O.C.D</i>	<i>O.M</i>	<i>O.M.D</i>	<i>O.M.D</i>
<i>1</i>	<i>D+O+C+M</i>	<i>D</i>	<i>D</i>	<i>O.D</i>	<i>O.C</i>	<i>O.C</i>	<i>O.C.D</i>	<i>O.M</i>	<i>O.M.D</i>	<i>O.M.D</i>
<i>2</i>	<i>O.C.M.D</i>	<i>D</i>	<i>D</i>	<i>O.D</i>	<i>O.C.D</i>	<i>O.C.D</i>	<i>O.C</i>	<i>O.M.D</i>	<i>O.M.D</i>	<i>O.M</i>
<i>3</i>	|	|	|	Φ	|	|	|	|	|	|
<i>4</i>	|	|	|	|	<i>D</i>	<i>D</i>	<i>D</i>	|	|	|
<i>5</i>	|	|	|	|	<i>D</i>	<i>D</i>	<i>D</i>	|	|	|
<i>6</i>	|	|	|	|	<i>D</i>	<i>D</i>	<i>D</i>	|	|	|
<i>7</i>	|	|	|	|	|	|	|	<i>D</i>	<i>D</i>	<i>D</i>
<i>8</i>	|	|	|	|	|	|	|	<i>D</i>	<i>D</i>	<i>D</i>
<i>9</i>	|	|	|	|	|	|	|	<i>D</i>	<i>D</i>	<i>D</i>

Table 66: Transition power matrix for OSF negotiation analysis (Φ indicates that no party is control)

Preference Ordering

The following matrix (Table 67) gives the order of preference of the participants.

	<i>O</i>	<i>C</i>	<i>M</i>	<i>D</i>
<i>SQ</i>	7	4	4	2
1	9	5	5	3
2	10	6	6	4
3	6	10	10	1
4	1	1	7	9
5	3	2	8	8
6	5	3	9	10
7	2	7	1	6
8	4	9	2	5
9	8	8	3	7

Table 67: Preference ordering for the participants

Clearly OSF would prefer to retain the goodwill of an important potential partner while doing what is necessary strategically to restructure share ownership. Thus state 4 is the best preferred. Generally OSF would not let a piece of potential business stand in the way of a strategic necessity, so that states 7 and 5 are well preferred also. The potential business at this stage is seen to be a secondary issue, but this assumption represents an important area for examination.

The other two bidders would clearly be less than desirous of seeing OSF partner (by implication against them) with another. Lastly, although DK may withdraw its goodwill, it is judged to do so unwillingly. From a business point of view, having to withdraw for purely tactical reasons from a desired partnership on ‘the series’, would not be desired by DK.

Motivated Power

Table 68 gives the feasible, motivated transitions between states.

	<i>SQ</i>	1	2	3	4	5	6	7	8	9
<i>SQ</i>	Φ	|	|	<i>O.D</i>	<i>O.C</i>	|	|	<i>O.M</i>	|	|
1	<i>D+O+C+M</i>	<i>O+C+M+D</i>	|	<i>O.D</i>	<i>O.C</i>	<i>O.C</i>	|	<i>O.M</i>	|	|
2	<i>O.C.M.D</i>	<i>D</i>	<i>O+C+M+D</i>	<i>O.D</i>	|	|	<i>O.C</i>	|	|	<i>O.M</i>
3	|	|	|	Φ	|	|	|	|	|	|
4	|	|	|	|	<i>D</i>	<i>D</i>	|	|	|	|
5	|	|	|	|	|	<i>D</i>	<i>D</i>	|	|	|
6	|	|	|	|	<i>D</i>	<i>D</i>	<i>D</i>	|	|	|
7	|	|	|	|	|	|	|	<i>D</i>	<i>D</i>	|
8	|	|	|	|	|	|	|	|	<i>D</i>	|
9	|	|	|	|	|	|	|	<i>D</i>	<i>D</i>	<i>D</i>

Table 68: The transitions which are both motivated and empowered

This table is derived from Tables 66 and 67 by application of the Powergraph algorithm.

Transition Diagram

Figure 62 shows the transition diagram equivalent to Table 68.

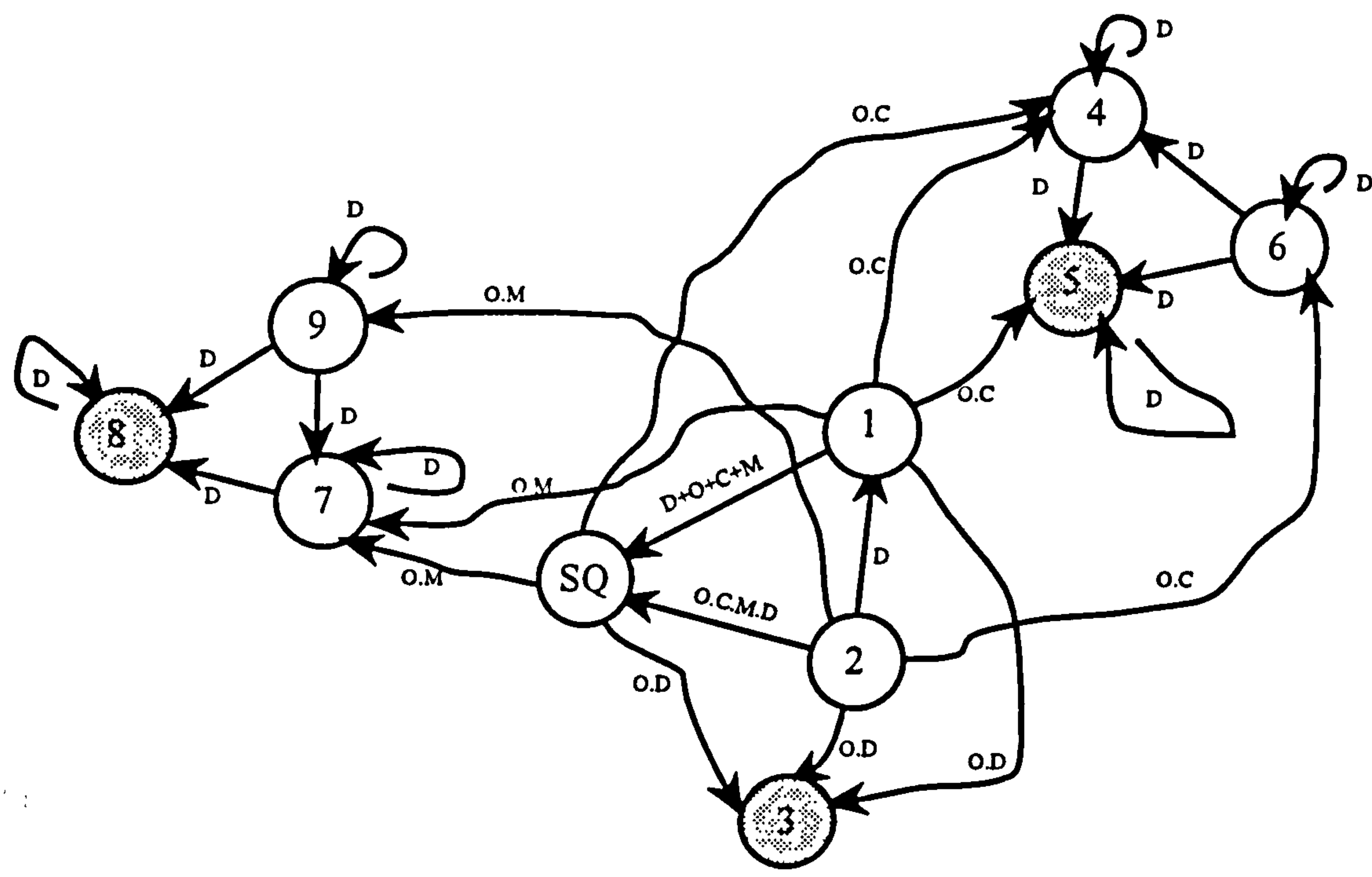


Figure 62: Directed graph for OSF negotiation analysis. Equilibrium states are shaded

Immediate simplification can be made to figure 62 by removing state 2 and its connections, using the argument that since state 2 can never be entered (it has only outgoing arrows), neither can it subsequently be left. Unless it appears as a start state, then, it is an encumbrance. Similar arguments then apply to state 1. Figure 63 below shows this simplified diagram. This can be easily seen to reflect the expected characteristics of the business situation; OSF are in control of the initial acceptance of the offers, but that if either the CC or HM offers are taken, DK achieve control, being able unilaterally to control those things which are in its control, and in particular its goodwill towards OSF and its new partner. One state, 3, where minority share holding change takes place by agreement with Bob

Morton, allowing an increase in operational funds, reflects the thinking of the EFAR strategic graph analysis above) and has the advantage of being less likely to alienate DK.

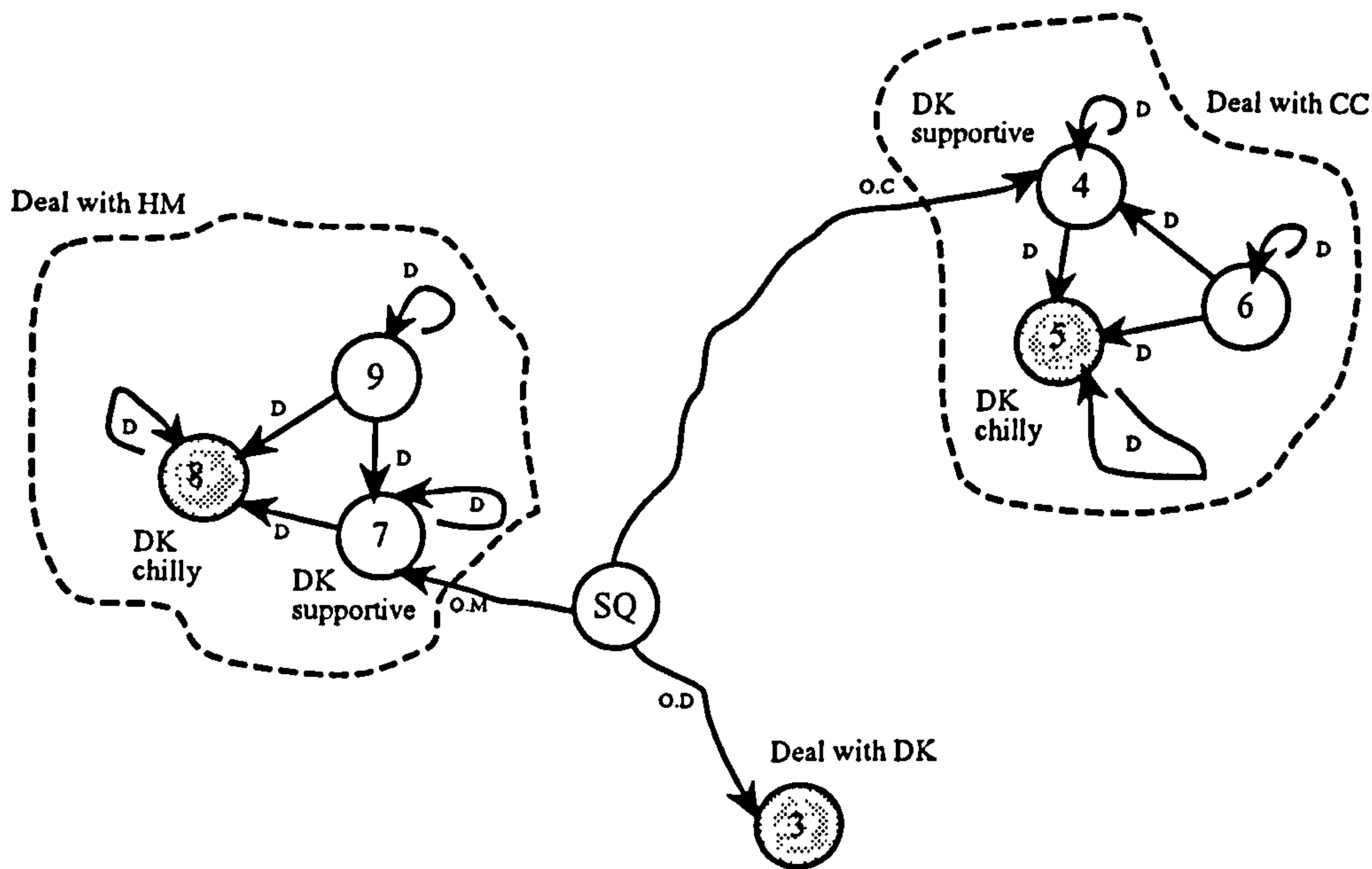


Figure 63: Simplified transition diagram for OSF negotiation analysis

Figure 64 below shows the critical transitions on which the action planning questions will be based. The figure takes into account that states 6 and 9 have no entry routes to them.

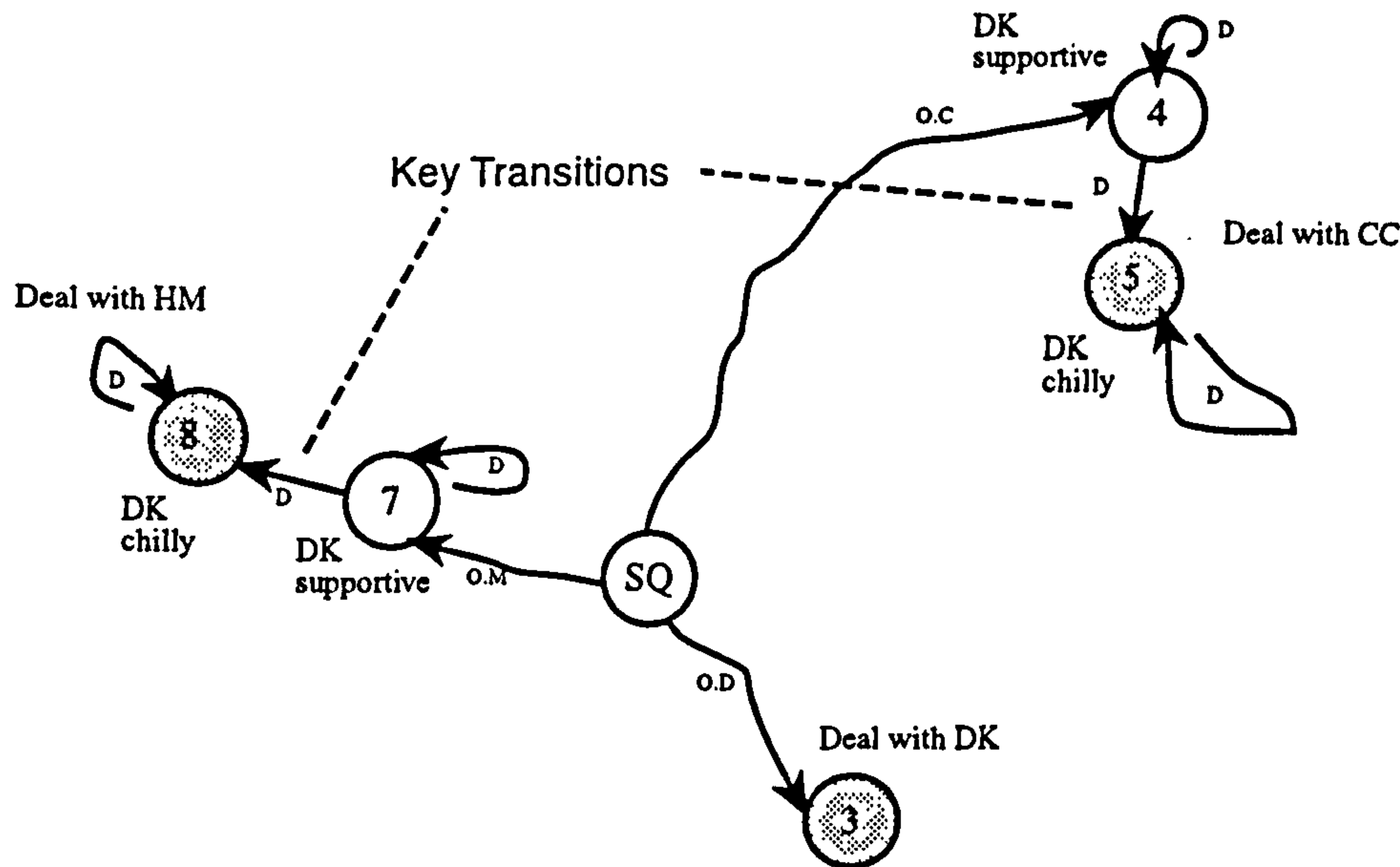


Figure 64: The critical transitions in the OSF negotiation analysis

Action planning and sensitivity analysis

The figures and structural analysis above give directions as to where thought should be applied to control the outcome in so far as OSF has influence.

Desirability of outcome

First, OSF needs to answer the question of which of the equilibrium states it would prefer, namely 8, 5 or 3. This is analogous to the minimax solution used in game theory; one is asking what can be done for the best if the environment or opposition acts in our worst interest. Here our choices are to move to 7, 4 or 3, after which DK will (under the assumptions of preference ordering, move us to one of states 8, 5 or (trivially) 3 respectively.

State 3 represents a minority deal with Bob Morton. DK is viewed here to have no further influence over the state of affairs, the argument being that this should not be viewed as an opposing move to DK, but rather as a withdrawal from a strategic position. The argument could be presented that the decision to take a minority share deal was arrived at as a result of conversations with prospective partners. DK would look rather foolish in their own marketplace if they withdrew goodwill as a direct result and in a fit of jilted pique. However, since share dealings in OSF are completely private in nature, there is no reason why DK should find out that such a deal had taken place for some time. One might even argue that the existing management of OSF might have a duty of care to keep such privileged dealings private, a duty which would transcend the generally accepted virtues of open and honest dealing.

States 5 and 8 represent the situation where a deal has been done with one of the partners (choosing between them purely on the basis of their utility to the interested OSF parties) and then accepting that DK might be prone to withdraw their goodwill on 'the series'. The effect of this on the deal should be relatively easy to determine. A key piece of information is whether the prediction of business in conjunction with DK is part of the valuation (formal or informal) being made by the bidders. This is of course not the only consideration, since it is possible that the relationship with DK is an important part of the business context for

the new operation. Possibly advice may have to be taken from the bidders, but a company which acts in an ostensibly irrational manner over the loss of a buying opportunity to a near-competitor will lose credibility in the wider market place.

In the end the decision comes down to a straightforward revenue prediction in the three cases, taking the pessimistic view that while DK would continue with its other activities, 'the series' would have to be done with another partner.

Adjusting DK's power and motivation

The more pro-active approach is to enquire what power and motivation DK is using to move the situation to states 8 and 5 from states 7 and 4 respectively. The following will be detailed for the possible sale to CC. The HM version follows *mutatis mutandis*.

Sustainment power at state 7

Having accepted CC's offer, we are put under the influence of DK in respect of their business relationship with us. Sustainment power refers to the ability of a participant to sustain the situation at a state in the face of the power available to others in moving it away. Here we ask the question, 'What can we do to take control away from DK so that we can keep their business?'

One must enquire whether OSF has rather more power than is being assumed in respect of 'the series'. It may be that we have power in sustainment because of the uniqueness of our service. If that were not the case, can the concept be amended so as to make the series uniquely tractable by OSF. Similarly, one might look at weakening the importance of DK to the concept; if DK were to feel that they were only one of a number of attractive partners, their sustainment power would be weakened. Lastly, one could postulate the signing of a contract which bound DK and OSF (and its successors) together, perhaps using the argument that the series deal should not become subject to 'planning blight' if the strategic situation of OSF continues overlong. An amendment to this approach would be the delay of the share sale to the point where the series is prejudiced, thus invoking the need for tangible

progress to occur with DK, resulting in at least a partial *fait accompli*.

Power to induce transition to state 8

DK's influence over this transition lies in the assumption that it is DK which brings the spark of feasibility to the project; their power lies in the freedom of action which they have to withdraw if they think it appropriate. Insufficient information is available regarding 'the series' opportunity to be authoritative, but the initial line of investigation should cover at least the following issues:-

If DK were to carry out the series work with another party would the return be as good, either in terms of financial return or in terms of risk?

Is it in fact OSF who call the shots on the opportunity? It could well be that judicious strengthening of the negotiating stance on 'the series' would imbue DK with an understanding that OSF have an influence over whether the work will be successful or not.

Motivation to transit to state 8

Attacking DK's motivation to withdraw their support on the series work is also a possibility. For example, it could well be that other work may be identifiable which would be attractive to DK, but which they would know would not be forthcoming if they were to lose their heads over the prospective sale. This investigation needs to be extended to the activities of the two prospective buyers, since it may well be the case that DK have opportunities or indeed existing business with either or both which could serve as a restraint on their reaction to the proposed sale.

Summary

1. A judgement must be made as to the relative desirability to OSF of having a minority share deal completed with Morton probably with a sustainable relationship with DK and, on the other hand, a total sale to either CC or HM with a withdrawal of DK's proposed business relationship with OSF on 'the series'.

2. As indicated above, the business relationships between OSF and DK and between the two bidders and DK must be examined carefully for existing and possible linkages which lead to either a reduction in DK's power to remove their series business opportunity or to reduce their motivation so to do.
3. An examination of 'the series' business opportunity to identify what OSF bring, and the extent to which that is irreplaceable must be carried out.
4. Ultimately, the best decision may prove to be that OSF makes a minimax judgement, based on choosing the best option under assumptions that DK, for whatever motivation, have done the worst for OSF. This will emerge from action 1 above

Resolution of OSF's situation

The result of the complex negotiation described above was quick to appear (Goldie - Morrison, 1996f). The decision was made after a further discussion with Circle Communications that a deal could be achieved, but the details of the transition from 4 to 5 formed a part of the discussion, since a component of the valuation of OSF from CC's point of view was the deal on 'the series'. The action chosen was to approach DK directly, and put it to Peter Kindersley, the chairman, that the goodness of 'the series' was independent of the ownership of OSF. If the deal was a good one before OSF became available for sale, then it was a good one with another potential ownership. Fortunately DK were neither too upset about losing the purchase opportunity for OSF nor particularly dismayed about the role of CC, since they did not view the latter as significant competitors. In view of their imminent cash flow problems (a factor not fully appreciated at the time), DK decided that they would allow the deal with CC to go ahead without any interference.

As a result an agreement was struck with the majority shareholders of OSF to sell a controlling interest to CC, shortly followed by an agreement to sell the small remaining minority of privately held shares.

OSF now forms a successful part of Circle Communications, with the previous owner/MD and the senior staff holding down key roles in a largely autonomous division of the company.

Interpretation from a foveal game perspective

With the framework of Chapter 5 in mind, the analysis supporting the strategic decision making of OSF in the above case can be described as:-

1) the generation of a **strategic graph** using EFAR which provides the overall framework in which the future options for the company are contained. In this case the understanding was reached that it was not the organisational issues which dominated the future for the company, but rather the need for the release of operational funds. The owner immediately focused on the important transitions from state 37 to state 33+, but this should not be interpreted as ignoring the remaining states of the strategic graph. While the action planning was centred on the achievement of a transition from the *status quo* to a majority share sale, consideration was given to the operational efficiencies needed to sustain operations under the existing paucity of funds. This turned out not to be feasible, for reasons which were clearly expressed in the problem statement.

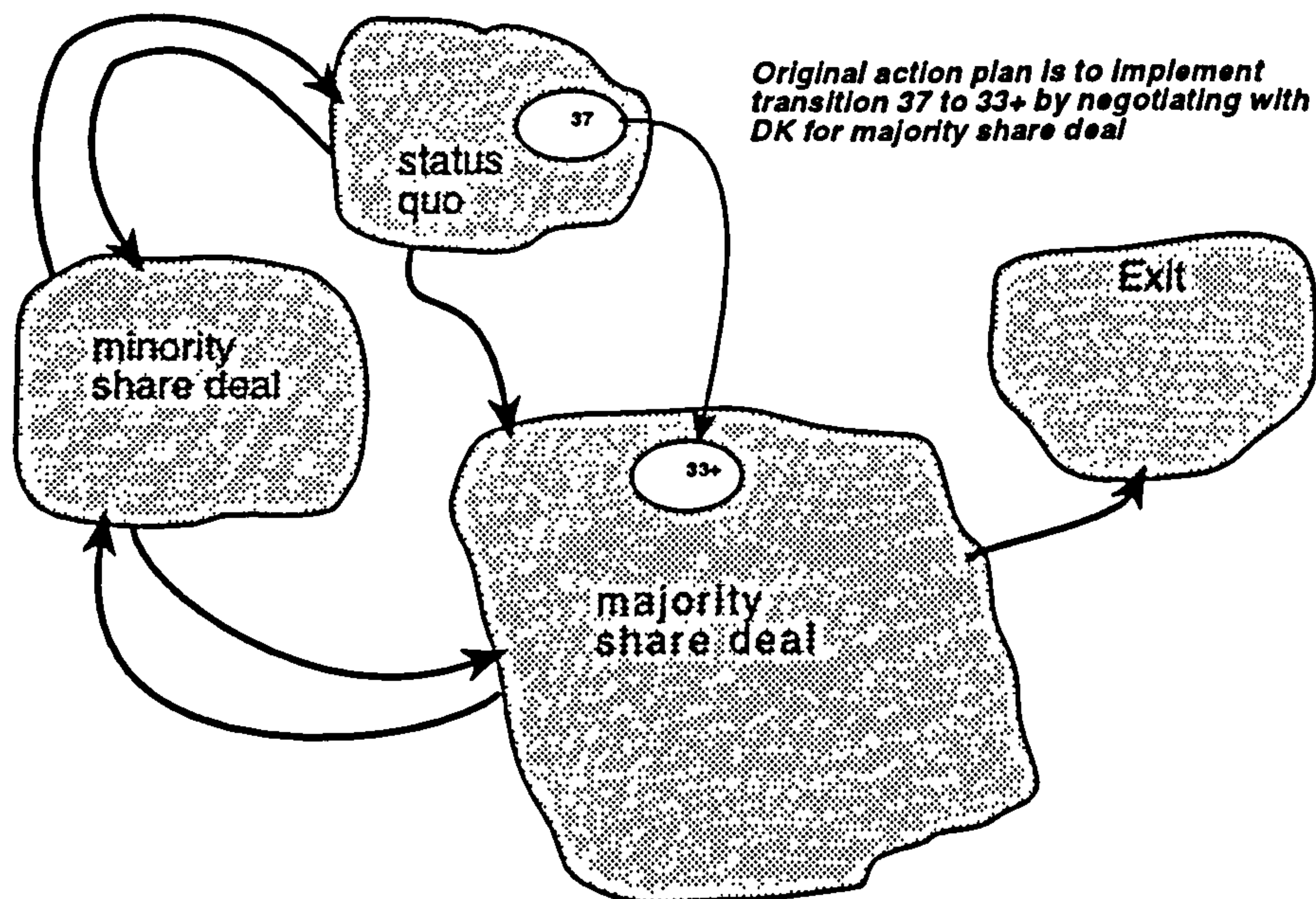


Figure 65: The original action plan entailed implementing transition 37+ to 33 by entering negotiation with DK for a majority sale.

2) the analysis of a particular state of the strategic graph, a **decision locale**, which formed the space within which a complicated and distributed negotiation took

place. This analysis was carried out firstly by informal means, when the owner/MD made an intuitive assessment of the options open to her in achieving a majority share sale. This informal analysis amounted to a series of discussions with Coopers & Lybrand to investigate the likely attractiveness and valuation of OSF and the likely extent of the interest. The owner/MD had an inherent preference for a sale to Dorling Kindersley because of personal contacts and there seemed no point to her at the time in analysing in any detail the negotiation which would ensue. There would be an agreed valuation of the company and a majority share sale would be made. The other minority shareholders would then, in all probability, want to join the deal, and the future would be once more clear and well-funded. As can be seen from the second part of the case study, however, the decision locale proved to be more complicated than she predicted. Because Dorling Kindersley were unable to convince the owner/MD of the desirability of accepting a bid from DK not just in terms of the value of the bid offered, but because of reservations as to the goodwill inherent in certain undertakings regarding the role of OSF within the DK empire, the transition from state 37 to state 33+ was aborted.

3) New information had, thereby, come to hand, however, which led to a **reappraisal of the strategic graph**. In discussing with both Coopers and Lybrand and the DK representatives it became clear that the valuation being placed upon OSF by the market was different from that assumed in the original strategic graph. In effect it was seen that a transition, previously undetected, was feasible between states 37 and 58+.

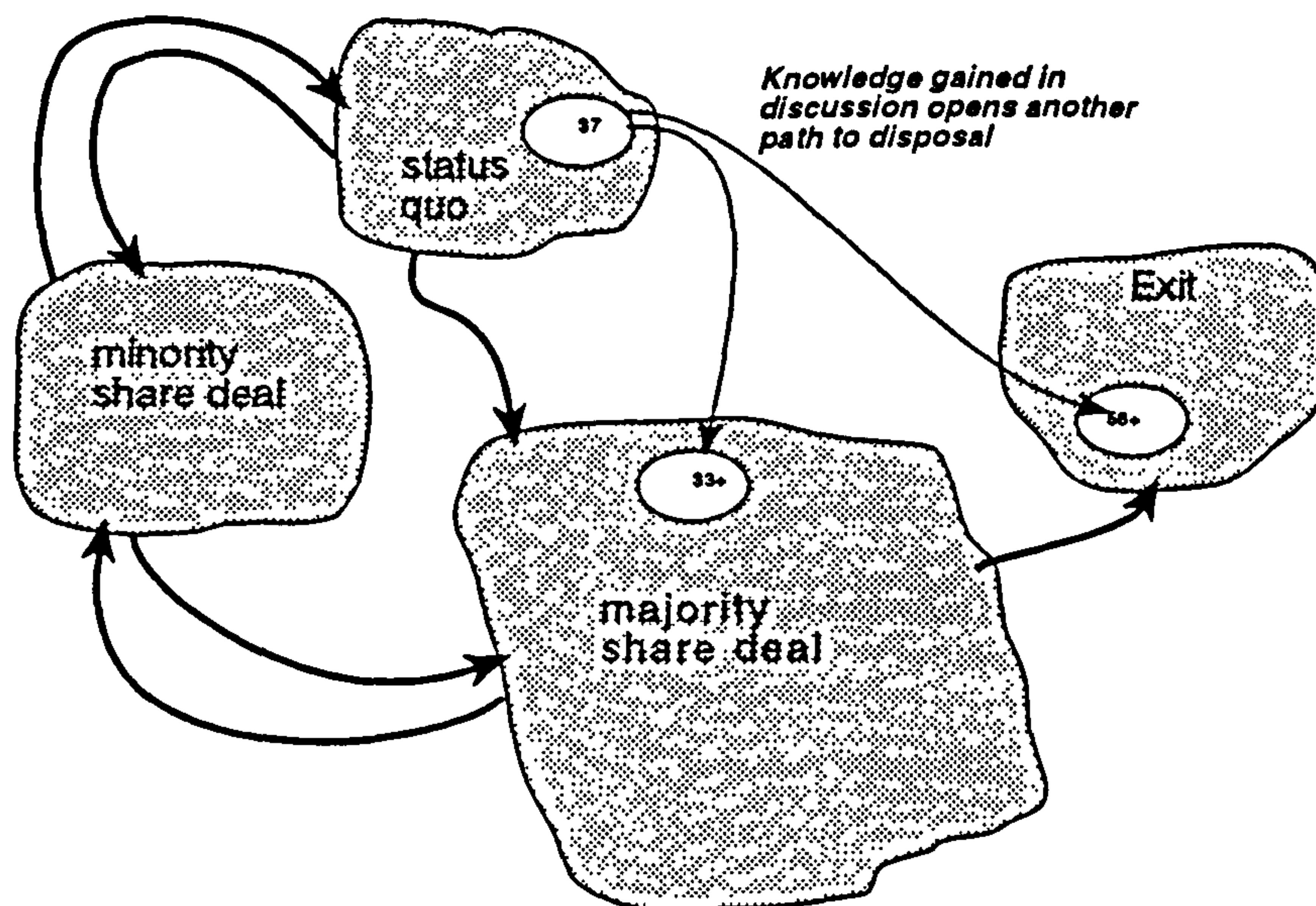


Figure 66: New information gained in negotiation showed a new path direct to the exit cluster.

The essential new perception was that the valuation of OSF from its point of view was very different than that valuation from the point of view of the potential buyer(s). From OSF's point of view operational funds were essential to raise the valuation of the company by realising the business potential, but from the point of view of the potential buyer the value of OSF lay in its technical superiority, the infrastructure to exploit which had already been laid down by the potential buyers. This differential assessment was detected by Coopers and Lybrand staff in the positions of a number of alternative potential buyers.

As a result of this new information the strategic graph shown above in Figure 66 resulted. We see here the effect of what is called in Chapter 5 a transition effect, whereby information gained in examining one decision locale can change the structure of the strategic graph. Specifically here we see the effect of the feedback loops of Figure 23 (Chapter 5), showing the effect of sensemaking and action planning combining together to improve the perception of the situation.

4) Within the new strategic graph, an attempt was made to execute the newly

perceived transition 37 to 58+. It was the attempt to carry out the negotiation to ensure this path which resulted in the complication of the interference of the Dorling Kindersley existing business ('the series') with the valuation of the other three parties. By this time the owner/MD had effectively rejected DK's offer, but had not declared that decision to DK until the new decision locale analysis had been carried out. The declaration to DK of their unacceptability was part of the action plan which resulted, and which can be seen in the final part of the analysis of the OSF case study.

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Chapter 11: Overall Justification and critique

Introduction

Previous chapters have described an overall framework for the consideration of strategic conflict and have shown how a particular embodiment of that approach is applicable through a number of practical studies. The main purpose of this chapter is to examine the justifiability of this particular embodiment by comparing the performance of the theory and practice with the criteria for justification and performance established in the early chapters of this work.

This justification is essentially divided into two parts. Firstly, it is appropriate to examine the extent to which the embodiment offered here complies with the criteria established at the end of chapter 2 resulting from the discussion in that chapter of the epistemic and ontological foundations of strategic decision making and the requirements which emerge therefrom. The two types of justification might appear separate, the former seeking arguments for justified belief in the method as a source of knowledge of a situation in hand and the latter seeking arguments for the efficiency or effectiveness of the solution in the light of what we know about strategic decision making, but this dichotomy is illusory, primarily because the criteria for justifiability under a constructivist paradigm are essentially those of practicality. Secondly it will be necessary to judge the embodiment against the criteria for justifiability established in Chapter 4, where the particular requirements for the justification of a method based on a constructivist paradigm are established. These are essentially criteria of effectiveness and are addressed through the examination of the collection of case studies already presented. The individual elements of the embodiment, namely EFAR and Powergraph, are separately considered along with the process as a whole.

Lastly, the potential development of the work is addressed in order to give indications of future work.

Justification and critique

Compliance with the requirements of the process

As has been noted, two sets of criteria for justification have been established, in Chapters 2 and 4. The former, deriving from considerations of what is necessary to support strategic decision making are summarised in Table 4. They are divided into three sections, namely *internal process*, *epistemic assumptions* and *contextual issues*.

internal process

The method should be based on the power, motivation and potential of participants

It will be clear from the description of Chapter 5 and the case studies described in subsequent chapters, that the core of the EFAR/Powergraph embodiment of the foveal approach is the representation of the powers and motivations of the participants. Here the method departs substantially from the previous approaches of Howard (1971) and of Fraser and Hipel (1989) in that whereas these authorities limited themselves to structures containing transitions controlled by only a single party, the present approach admits transitions controlled by groups and combination of participants.

The action planning part of the Powergraph element of the embodiment is essentially one of examination of the ways in which the various powers and motivations of the participants can be manipulated or strengthened by the application of resources at our disposal. In the case of the *BAe Project Staffing*, for example, in Chapter 9, it can be seen that the main part of the action planning process is the establishment of which participants control the important transitions and of establishing what could be done by the client company to strengthen the resolve of those participants in those transitions which it the client company viewed as desirable and to weaken the power and the resolve of participants controlling in part or completely

the transitions which the client company did not desire.

In the EFAR strategic graph representation of the context in which the Powergraph analysis is carried out, this concentration on the powers and motivations of the participants is less obvious, but is nevertheless at the heart of the process. In the EFAR action planning process statements are made which describe what has to be done in order to invoke desirable transitions and attenuate undesirable ones in the same way as in the more localised Powergraph representation, but the nature of the action planning product is different in the two cases. At the strategic graph level of the EFAR analysis the action planning product is much wider in effect, in part because of the general nature of the (low resolution) environmental description produced and in part because the mandate and resources for strategic intervention are inevitably greater than that at the operation level. Nevertheless the action planning results which emerge from both levels of analysis comprehend the powers and motivation of participants. This can be seen clearly in the OSF case, where the action planning resulting from the first level of analysis (the EFAR analysis) resulted in a set of interventions of a highly personalised nature between the owner/MD and the prospective majority share buyer, Dorling Kindersley. These interventions were then modelled in a more resolved fashion by consideration of the decision locale representing the negotiations

Lastly, while the top-down value based state generation method described in Chapter 8 is by no means essential to the foveal approach, when it is used, by its very nature, it produces a set of states which comprehends the motivations of the participants directly because their value systems form the basis for the very definition of the states.

It should not be bound by conventional game-theoretic views of equilibrium

The concept of equilibrium used in the Powergraph method is very similar to that of the Nash equilibrium of conventional game theory in that a state is deemed to be a candidate for rational equilibrium if there is no improvement path away from it which is both under the control of the relevant parties and appropriately motivated. Whereas in the conventional Nash equilibrium each individual player's motivation (expressed as utility) is considered independently (Rasmusen, 1989 pp 15, 23, 31-32; Fudenberg and Tirole, 1993; Heap and Varoufakis, 1995 pp 51-62), in the Powergraph representation the combinations of players acting together in control of the transitions determine the feasible improvement paths.

At a more fundamental level, it should be observed that the expressed intent of the conventional game theory approaches and that of Powergraph are not identical. As has been shown in Chapter 3, the Nash equilibrium concept is frequently criticised in game theory writing because it produces a plethora of 'solutions' (Heap and Varoufakis, op. cit. pp 51-55). The criticism would appear to be that the aim of the game theory analysis is to indicate what will happen in a given situation of conflict, whereas the aim of the foveal approach here is to provide an indication of what could happen in order that measures can be taken at a practical level to foster outcomes which are more desirable. The essential limitations induced in the strategic domain of differing belief spaces of the participants and by the lack of exact knowledge of the relative utility orderings of the participants of various outcomes renders impotent any attempt to obtain a single solution (even if it were to be accepted that such singularity existed).

It is not essential in the Powergraph analysis that any state should appear as an equilibrium state in the strict sense. It would be wholly appropriate to

represent, for example, a cycling, unresolved negotiation as a directed graph structure without an equilibrium. Such a directed graph would be equally fertile a representation for the discovery of appropriate action planning as one which possessed a single, apparently stable equilibrium state.

It should exhibit a depth-changing ability

The foveal approach exhibits this property in two separate ways. First, the relationship between the strategic graph and the more detailed local analysis clearly shows the resolving characteristics of the process. In the OSF overall case, for example, the strategic analysis of the company's competitive and organisational context of Figures 56 to 61 led the owner/MD to an improved understanding of the situation in which she and her company found themselves. From this wide ranging scan of the future environment, three states and their transitions emerged as being particularly relevant, namely the status quo and two negotiating states for majority share sale and total share sale respectively. In turn these three states became the subject for more detailed examination, both by informal means and by the use of Powergraph. Subsequently, the closure of the loop of Figure 20 shows itself in the reappraisal of the valuation of OSF on the basis of evidence gained in the negotiations (the decision locale under examination). We thus see a focusing effect inherent in the foveal approach embodied in the pairing of EFAR and Powergraph as, respectively, a low resolution wide-view method and a resolved specific conflict management tool respectively. We can also see this depth changing effect in the strategic graph of Figure 25, that of *BAe's Alternate Naval Strategy*. Here the depth changing is from the strategic view inherent in the directed graph to the specifics of the project based action planning needed to sustain the developments identified, here in particular the search for an alternative target company to but and the internal

response took an investment in risk management competence and infrastructure.

Second, the Powergraph method itself is strongly depth-changing in its characteristics. In the case of *The Spanish Mayor*, for example, the initial phase of analysis was fairly general in its extent. This in turn led to a more detailed analysis of the information surrounding the location and knowledge of the tapes. This, too, is a type of depth changing, in that this important information issue appeared as only a subsidiary issue in the first stage of analysis (Figure 54) but became the central part of the second analysis (Figure 55).

Figure 67 below, which is also applicable to later sections illustrates the connection between the elements of the embodied foveal approach and shows how the feedback process of successive phases of analysis lead to appropriate focusing of the action planning and sense making, achieving the double loop feedback inherent in Figure 23 of Chapter 5.

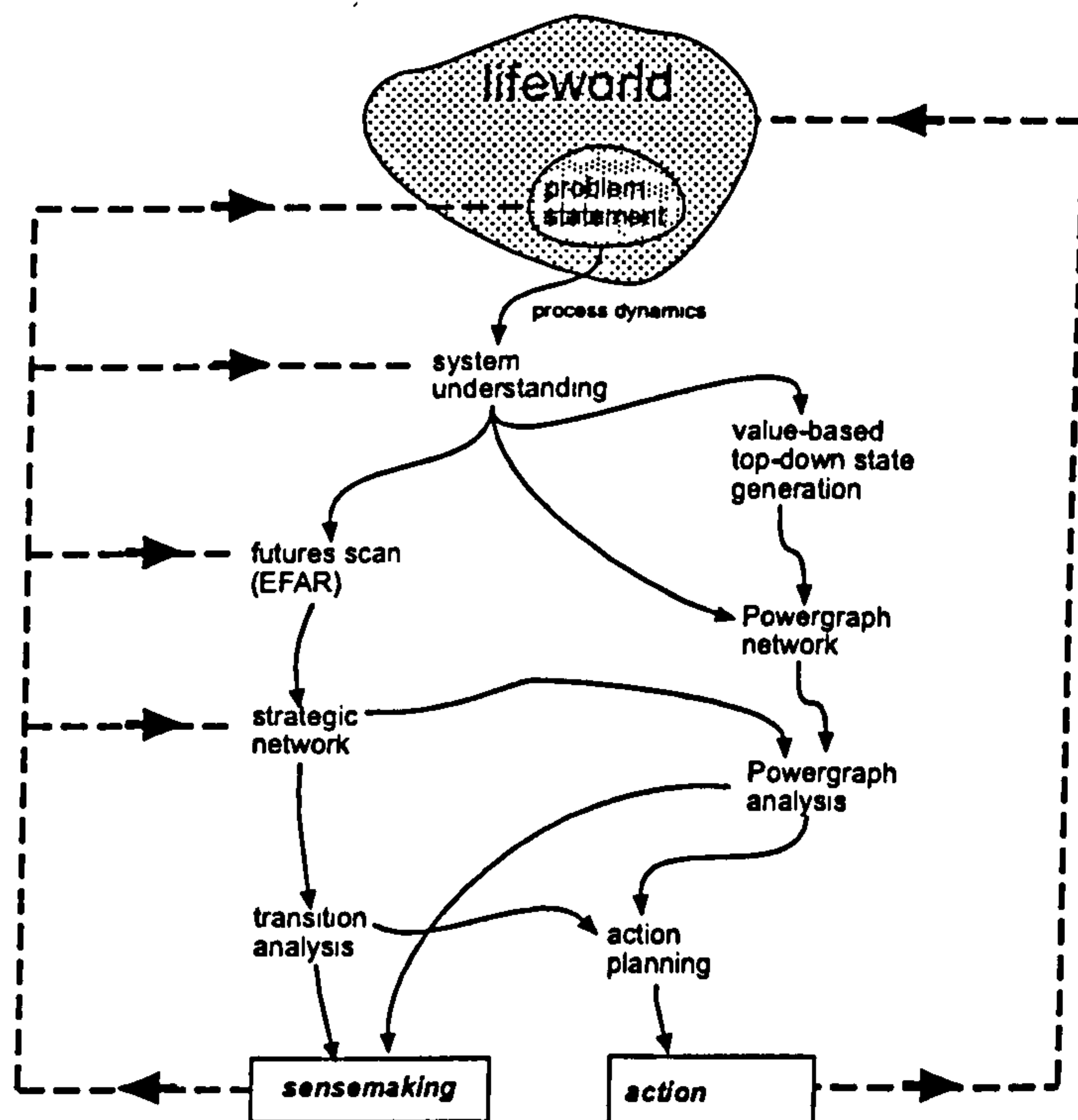


Figure 67: The feedback mechanisms in the embodiment of the foveal approach

The method should be data improving

The implication of this requirement is that there exists structure within the problem knowledge that, if disciplined, will produce new understanding which, in turn presents a more enlightened view of the data. Alternatively the new understanding allows the relevance of data to be newly addressed. The ordering and structuring of the data informs the problem. We can see this process in each and every case study presented. For example, in *The Spanish Mayor* case we see the structure of the directed graph giving relevance to the information already held by the parties, but which is not yet seen as being material to the resolution of the threat. When the importance of the knowledge as to who has the information on the location and contents of the tapes is appreciated, existing knowledge is mobilised. In the *Postage Stamp Crisis* case the structure of the network allows incompatibilities between the objectives of the participants to be perceived, so that the international community's actions become more easily seen.

It should be simple, auditable and transparent

It is submitted that the process described in all its parts is simple and auditable. The practical evidence of the *BAe Project Staffing* case, *The Spanish Mayor* and the *OSF Strategic Futures* case is that senior executives of large companies are able not only to follow the procedure during their participation in the analysis, but also to weigh retrospectively the results for reasonableness. The evidence in practice is that because both EFAR and Powergraph are essentially procedural, albeit with strong elements of subjective data, progress toward an understanding of the conflict is easily achieved.

There are gaps in its auditability, however, arising from the subjective nature of the information utilised in the process. The clustering process within

EFAR, for example, and the generation of states of play in Powergraph are essentially subjective in nature, and require recording other than through the procedure itself. This is a potential source of lack of traceability retrospectively.

epistemic assumptions

It should be acceptant of differing belief spaces

The foveal approach is inherently limited in the extent to which it can cope with differing belief spaces. While differences in perspective of the participants are encompassed through the mechanism of different rank ordering of preferences, for example, and while it is in theory possible to have different graphs for different players, the essentially singular viewpoint of the client company has dominance. If for example, we were sure that a competitor did not see a particular future because, say, we had proprietary information on an invention of which he had no concept, then we might be justified in believing that he would not encompass that set of future states, and would, therefore not be empowered to bring them about. We cannot be sure, however, since the very existence of that future or set of futures in our own minds may be mirrored by the thinking of the other party. Similarly, we cannot allow ourselves the paranoia of imagining that the other party can think of states and sets of states of which we can have no conception. That is almost certainly the case, but if we can have no conception of the nature of that set of future states then it is redundant to attempt any definition of them.

There is substantial material within the foveal approach to encompass the different belief spaces of the parties in the wide sense, but in the narrower terms of each party having potentially a different view of the playing space, the approach limits itself. This limit is set not by the method itself but by

the limitations of what is to be known in the problem situation *per se*.

It should be acceptant of limited, defective and deceitful data.

The method will operate not only with limited data, but also tends to target attention toward the areas where data is lacking. *The Spanish Mayor* case is relevant in this respect, since, between the first analysis phase (where the knowledge as to who knew the contents of the tapes was unavailable) and the second phase, the analysis targeted information gathering to fill the gaps in the knowledge of the consultant, the Mayor and his staff. As far as deceitful data is concerned, like any other procedure its usefulness will be limited by erroneous data, but the procedure does have the advantage of being able to target disjunctions between the actions of participants and what should occur as a result of the assumptions made about their preferences and powers. For example, in the *OSF Strategic Futures* case the existence of the development path directly from the *status quo* state to a full share sale was inferred from the actions (the offers) of the potential buyers.

A particular feature of the state based approach developed here is that it presents action plans from where the conflict has actually arrived (as distinct from where one would wish it to start). If, for example, in *The Battle for Trafalgar* case of Chapter 7, the analysis had been carried out real time as opposed to *a posteriori* and the motivations of the competitor/partners had been misunderstood, with the result that the situation gravitated to a state like *freeze out*, even though this state would not have been predicted by the model (since some element, say the preference ordering) was defective, the model would still produce development options from that unexpected state. The approach is thus robust to unexpected turns and twists in the development of the real situation and arbitrary and irrational actions on the parts of the actors.

It should cope with both hard and soft data sources

The input data to the model consists of a mixture of subjective and (apparently) objective data, and the balance between these types of sources will vary according to the situation. In *The Battle for Trafalgar*, for example, the motivations of the parties is in part derived from personal contact between the executives of the companies, and partly from numerical financial analysis of the values of the various options to the other two companies, GEC and VSEL. Thus both hard and soft data are combined in the same model. Similarly in the negotiation modelling for OSF (Chapter 10) the receptiveness of the companies in question, Dorling Kindersley, Bob Morton, Circle and Harmworth, are partly derived from the analysis by Coopers and Lybrand of the value of the deals to the parties, based on the actual balance sheets and the offers already received, and in part on the subjective information deriving from contact between the owner/MD and the bidders and between OSF's agents and the bidders. The model encompasses both types of data without discontinuity.

contextual issues

It should be adaptive to changing circumstances (ateleological).

The representation of the preference ordering in the method makes no assumption as to the end objective of the players. There is, it should be noted, a significant difference between having a particular state as the highest in preference and having that state as the objective of the conflict management. While that state may be most preferred, it may well not be within the compass of the player to achieve it. The nature of the representation of the conflict as a network of states among which the players move, allows states other than the nominal start state to be used as the instantaneous starting point for further analysis. In other words the procedure does not require analysis to start at any one point in the network arbitrarily

called the start point. As such conditional and contingent planning can be carried out.

This ability to cope with changed circumstances can be seen in a number of the case studies presented above. In the *Battle for Trafalgar*, for example, while the most desired state may have been (for BAe) the state *split*, where the two projects in question were carried out with different partners, the structure of the conflict can be seen to militate against *split* as a solution, with the result that either of the other two equilibrium states (which were more preferred than the eventual actual result, could have been reached. When the actual preferences of the other partners were observed the model was easily changed to accommodate that new information.

It should be anthropic

It will be observed that while the whole foveal approach is procedural in design, the elements of which the resultant models are concerned, either in the EFAR representation or in the Powergraph models, are comprehending of the human nature of the interactions represented. In particular the EFAR networks are soluble only by taking into account the power structures of the participants and their motivations both individually and within the context of their organisations. Similarly the process of seeking the equilibrium solutions of the specific conflict management technique, Powergraph, involves the examination of the powers and motivations of the participants, a process which militates for an approach which recognises the free will and motivation of those players.

It should be system-centred, vis-à-vis self-centred.

The constraints of the subjective world problem, described in Chapter 4 (Figure 13) and Chapter 5 (Figure 22) limit the extent to which any

representation of a multi-participant system from a constructivist viewpoint. Our view of the system in focus is necessarily limited by the extent to which we can conceive of other players' knowledge. Within that limitation, however, we can see clearly in all the case studies presented that the effect of the deliberate deconstruction of the problem by the foveal approach into a series of connected, local examinations of transitions within a network, is to focus the attention on the factors which define the situation from the client company's point of view within a structural framework, but also to force examination of the other players' strengths and desires within the framework of our own objectives. The effect of this dual view is to force a viewpoint which is no longer one of the client company alone (i.e. self-centred) but encompasses the viewpoints of the other participants (i.e. system-centred). The value of the foveal game approach is that struggle is viewed and managed from within a context of the structural constraints on behaviour. This is inherently and essentially a system-based view.

It should be aware of the social context in which it operates.

Many of the observations of the previous section apply to this requirement of a conflict management approach. While the original conception of this requirement emerges from a socially sensitive ambition on the part of systems workers (a motivation which may well not be shared by the client company's representatives), it can be interpreted here in terms of the power structure within which the models are assessed. For example in *The Battle for Trafalgar* case the assessment of the willingness of VSEL to break a potential agreement is in part based on an understanding of the allegiance felt by their management to the workers, many of whom are their neighbours and one time school friends within the Barrow-in-Furness region To the extent that such information on the social context is available,

it can be incorporated into the thinking of both the EFAR technique and of Powergraph.

It should be complementary with and contribute to systems methods.

Because of the focusing effect of the foveal approach a number of techniques can be used to provide structural knowledge about the conflict. It is, for example, not necessary to apply Powergraph to the resolution of issues at a particular decision local of the strategic game. Although this work concentrates on the particular embodiment, a contribution could be made as appropriate by any one of a number of techniques, particular the soft system methodologies and associated techniques addressed in Chapter 3.

Compliance with criteria for justifiability criteria

The criteria for justification of the techniques and frameworks involved here are reviewed and established in Chapter 4.

internal

stability

As discussed in Chapter 4, we should expect that with a well-defined set of entry conditions, the procedures applied should produce stable, repeatable results, this being distinguished from any external requirement of stability or replicability, a requirement which, as has been discussed, is not within the reach of a method aimed at the representation of strategic conflict.

The embodiment of the foveal approach described here consists of a number of elements each of which contains both procedural, algorithmic components and subjective, non-procedural components. For example, the multi-futures tool, EFAR, which is aimed at producing a strategic directed graph for later, more resolved examination, consists of a strict procedure for generating a

rich space of possible futures on the basis of choices made among a table of possible values for a set of sectors or characterising variables, These choices each in turn, then describe a member of the set of possible futures. The next step in the procedure is to identify and record incompatibilities in the choices of values for the sectors and to eliminate those choices which are mutually incompatible, thus reducing the size of the set of all possible futures. The last step of the procedural part of EFAR is to cluster together sets of possible futures which are viewed as being sufficiently near in their definitions as to be indistinguishable one from another. Figure 24 summarises the procedure.

Examination of these three steps reveals that for a specific set of well-defined sectors (characterising variables) and values of those sectors, together with a specific set of entries to the compatibility table (e.g. of Table 12), a single, well-defined set of possible futures will result. The process is simply a naming procedure and a selection from all possibilities of choices from the field values on the basis of declared and unique one-to-one relationships in tables such as Table 12. Similarly, the subsequent clustering process, while subjectively based is well-defined. There is no confusion as to the clusters which result. Clearly, to the extent that the subjective information applied at this stage is confused or uncertain, alternative clusters will present themselves, but for any particular input of information (i.e. the pragmatically-expressed criteria for grouping of the states) the EFAR directed graph or strategic graph will be unique. To the extent that the information inherent in that naming, filtering and clustering procedure changes, then the output will also change. Similar arguments apply to the information applied to the transition matrices which are exemplified by Tables 12 and 13. A specific application of information will result in a specific transition table, not least because the information input to the procedure is defined by the tables themselves. Thus the process up until this point, the generation of a directed

graph among defined groups of future states, is procedural and stable in the limited sense addressed here.

This strategic graph is now applied in one of two possible ways, namely as a direct input into the action planning process or as a set of boundary conditions for more localised, specific conflict modelling using, in this embodiment, Powergraph. Here there is an apparent lack of stability in the EFAR element of the procedure, since the argument could be offered that the action planning resulting from the directed graph could be different at different times and with different understandings on the part of the user. Such an argument fails for the following reasons. Firstly, no claim is made in this work that the action planning itself is part of the foveal procedure (since it mobilises a very wide range of frameworks and procedures not covered here and generally available to any competent strategic manager), and secondly, the inconsistencies from application to application result from the different information comprehended by the different users at different times. Thus the EFAR element of the procedure can be considered to be stable.

The Powergraph procedure, too, is subject to similar arguments. It consists of a procedural element, namely the naming of states, the expression of transition expressions which describe the ability of participants to invoke moves between these states and some equilibrium process which allow the identification of likely resting points of the system.

The first part of the procedure, namely the definition of the states, the declaration of the relative utilities and the description of the boolean expressions is stable in the sense meant here since they are merely declarative of the understanding held of the conflict. Similarly the application of the relative utilities to the boolean expressions is a straightforward evaluation

of the boolean expression, a procedure mathematical in nature and clearly stable, it being a mere evaluation according to simple rules. This leads us to the conclusion that the Powergraph directed graph is stable in the sense understood here. It is connected uniquely with a specific set of input data.

We are left, then, with the issue of whether the equilibriums identified are stable. Examination of the algorithm described in Chapter 7 (Figure 36) will show that the procedure for equilibrium identification has clearly defined steps and inputs, and is therefore stable in the sense required here. Its correctness, it will be noted, is a different matter and is addressed separately.

To the extent, then, that the output of the foveal approach consists of the application of the procedure to produce various representations of the conflict it can be seen to provide a single result from a specific input. It is therefore stable overall in this sense. What is not claimed is that the use of the foveal approach to generate action planning product is stable. The procedure may well be stable in this respect, but it is impossible to detect in any application what the inputs are (since they are so extensively subjective and undeclared). This is a fundamental limitation of proof of any procedure subject to and concerning itself with human activity systems (Guba and Lincoln, 1994).

consistency

Related to the stability requirement is the need for the procedures to be internally consistent. A failure of consistency should be expected to show itself in the application of the approach through the appearance of descriptions of the situation or understandings which are mutually inconsistent one with the other. For example, application of the procedure would throw up states which were at the same time discovered as equilibriums and not as equilibriums by the application of the procedure.

We might expect to see states of affairs which had duplicate definitions; we might expect to see competing expressions which describe the powers of participants in the directed graphs; we might expect to see more than one competing solution to the motivated power matrix when the relative preference ordering is applied to the power matrix. None of these effects have been observed throughout the application of the method to the cases described above.

The level of proof exhibited here is analogous to that in the generally accepted scientific method, namely that if there were internal inconsistencies in the approach, we should expect them to evince themselves in the outputs. The hypothesis that the procedure is self-consistent is thus falsifiable. To the extent, then that no such evidence exists, then we can accept the hypothesis until counter-evidence is available. On this basis the evidence of the case studies shows consistency.

traceable

We should expect the procedure to be traceable or auditable. This implies that it is possible to express sufficient detail in the procedure to allow an appropriately qualified or experienced person to audit the procedure for the correctness of the steps of calculation or syllogism.

The traceability of the method can be judged from the case study material offered in this work. The procedural aspects of the approach can be seen clearly to be traceable, both in EFAR and in Powergraph. Naturally, when subjective, experiential information is included in the procedure (for example, when in EFAR the compatibility matrix is filled on the basis of exogenous understanding of the business dynamics), the traceability of the process will be limited by the assiduity with which this new information

input is recorded. Once the information enters the foveal process, however, it is traceable and auditable, as can be seen from the examples given. Moreover, the algorithms declared above which define the procedure offer the basis for tracing of the decision making process at will.

inclusion

We should also expect it to provide answers which mirror those of other techniques in so far as those techniques can be audited for correctness. The game theory examples of chapter 7, of *Battle of the Buddies*, *Chicken* and *Prisoners' Dilemma* indicate clearly that the results of these exhaustively treated archetypes are included in the solutions of the same situations by the foveal approach. In each case shown the main results are reproduced by the alternative foveal approach, and in all cases new insight into the mechanisms of resolution of the conflict appear.

external

transferability to users

It is reasonable to expect that a technique for practical application should be usable by practitioners other than the inventor. The involvement of the two sets of informants in the BAe project Staffing Case and in the OSF overall case in the process shows some evidence of transferability. In both these cases the informants engaged themselves fully in the process, showing facility in using the method. It is recognised that this is not the same as an independent verification of the usability of the method.

Of more direct effect is the work (Price, 1997) of a successful attempt made by a senior practitioner in Arthur D Little Ltd. to apply the method to a competitive analysis case.

The EFAR method is clearly transferable, having been used (Munro, 1996)

in the analysis of an IS strategy problem and subsequently (Munro and Powell, 1997).

chronological stability

We should expect that when applied to a historical example the technique will reflect the progress of the conflict under investigation within the contemporary limits of knowledge of the participants. Evidence for the chronological stability of the method can be drawn from *Mardonius and the Greeks* and *The Battle for Trafalgar* (Chapter 7), from *The Postage Stamp Crisis* (Chapter 8) from the *BAe Project Staffing Case* and *The Spanish Mayor* (Chapter 9) and from the *OSF Strategic Futures* overall case. In all these cases there is clear evidence that the model produced by the approach is consistent with the facts as they subsequently appeared. For example in *The Battle for Trafalgar*, the decision by BAe to offer the two cooperating companies conflicting project involvements resulted in BAe gravitating into a well-defined state of the model, whereby BAe is only able to prosecute one of the projects, the frigate. The sequence of events which led to that situation is clearly represented in the model trajectories. Similarly in *The Postage Stamp Crisis* the trajectories predicted by the model for Nicaragua and Honduras are reflected in the historical resolution, even to the extent that the subsequent flare-up of the border dispute is predicted from the 1937 analysis. In the *BAe Project Staffing Case* the effects of the inaction of BAe are clearly predicted by the model and are reflected in the eventual result of the negotiation. Lastly, OSF's negotiation model of Chapter 10 shows retrospectively the conflict between Dorling Kindersley's desire to obtain control of OSF and the negotiating space available to the owner; again the trajectories are successfully predicted when judged *post facto*.

contemporary validity

During the intervention in which a technique is applied it should be expected that the results should align with the perceptions of the researcher and informant(s) at the time. Two cases in particular provide evidence that the contemporary validity of the method is high, namely the *BAe Project Staffing Problem* and the *OSF's Strategic Futures* overall case. In the latter, as the informants and the researcher applied the method it was noticeable that the informants were confirming their conceptions of the problem situation against the model, and there were frequent occasions where the emergent structure of the model provided improved sensemaking for the informants. Their reaction throughout the application period was that the emerging model was consistent with their view of the situation. For them it exhibited contemporary validity.

The OSF case is even more supportive. It was observed here that the primary informant, the owner/MD was using the procedure to make sense of the environment on a continuous basis (Goldie-Morrison, 1996c,d,e,f). The evidence that the sensemaking product of the foveal approach resulted in her committing her personal wealth to its results (Anon, 1969) witnesses that the method had, indeed, contemporary validity for her.

contemporary valuation

Critical to the justifiability of the supporting techniques and frameworks is the concept of the usefulness of the results to the researcher-informant. The *BAe Project Staffing* case shows evidence directly that the product of the approach was deemed worthy of inciting action by the informant. The evidence emerging from the model that a particular line of advocacy was required instigated a particular change in the line of argument of the consultant in question. This is evidence that the new perception of the

problem induced by the approach was valued to the extent that action resulted (Snarey, 1996). Observations by both the consultant and the informant at the time of the analysis were that the procedural structure coupled with the ability to mobilise subjective information allowed a degree of understanding of the problem which was not available before hand. Moreover, the efficiency of the procedure was valued by the informant, in the sense that the modest amounts of time which he had to fund and personally contribute were entirely consistent with the timescale and importance of the problem. The procedure clearly made a contribution. Before the analysis Mr. Irvine, the informant, appeared completely at a loss as to what freedom of manoeuvre was available to him, what action he could take, and was visibly frustrated by the lack of structural understanding he possessed about this important situation. The evidence of its valuation to him can be found in his willingness to contribute not only funding for a consultant, Mr. Snarey, to contribute to the analysis, but also to contribute his own time to the project. Lastly, the fact that he took action to implement the findings of the analysis is itself evidence of contemporary validity.

More strongly, in the *OSF Strategic Futures* case there is overwhelming evidence of contemporary valuation by the informant. First, the engagement of the owner/MD herself in the process is evidence that the effort expended was seen as appropriate in return for the perception and understanding achieved. Second, the engagement of consultants (Coopers & Lybrand) to implement action plans resulting from the foveal approach to the OSF problem is evidence that the output was financially valued. Third, the commitment of the owner/MD to a line of action (selling the company) at some risk to her own personal wealth is the clearest evidence that the process was valued. It was only through the establishment of the strategic scene through the application of EFAR and the subsequent more detailed

negotiation analysis that the sale of OSF was able to be drawn to a conclusion. Before the application of the foveal approach the owner thought that she merely had a problem with her organisation; the application resulted directly in the decision to change the ownership of the company.

This last case study, OSF, illustrates well the separate usefulness of the strategic directed graph analysis and the more detailed local conflict resolution tool. The understanding gained by the owner/MD of OSF as to her strategic situation was valued by her of itself. Before the analysis she was of the opinion that her problem was to decide whether she should consolidate her organisation or not (Goldie-Morrison, 1995). The understanding that her company stood in a competitive market environment was not new to her, but the degree of interrelation between that environment and her internal freedom of action was of clear value to her, as evinced by the subsequent employment of costly management consultancy expertise to bring about a particular action plan, namely the sale of the majority of the company.

The effectiveness of the conflict resolution analysis can be measured only by the difference in freedom of manoeuvre which the owner/MD achieved before the analysis with that gained after. Prior to the analysis summarised in Figures 62, 63 and 64 of Chapter 10, the owner/MD was unable to negotiate with Dorling Kindersley for fear of causing them to withdraw from the important project ('the series') which they were potentially using as a lever to obtain a favourable negotiation on the bigger issue of the sale of OSF. With the understanding of the structure of the situation summarised in Chapter 10 the owner/MD could enter the negotiations knowing that she understood the structure of the whole negotiation at least as well as any of the parties. Moreover, by understanding that structure, she was able to

identify the consequences of negotiating moves before commitments were made. The analysis was valued by her, then, both at the strategic, general understanding level and at the level of detailed, negotiating tactics.

Shortcomings and future work

The embodiment of the foveal approach described here, as evidenced by the case studies described does achieve the aim of the research, in that it is a justified and appropriate technique for understanding and predicting strategic conflict, but like any approach or set of techniques with a practical intent, it has shortcomings.

Multiple perspectives

One of the significant limitations of the approach is its capacity to cope with the multiple perspectives question whereby the different players present (to themselves in sensemaking and to the lifeworld through their actions) a view of the conflict which others may not share. The foveal approach attempts to resolve this in a practical sense by mobilising knowledge (or at least preconceptions) of the other players' motivations in generating the discrete states on which the analysis is based. This is formalised in the top-down value-based technique of state generation described in Chapter 8, but is inherent in more informal state generation methods. Secondly, the foveal embodiment described here utilises the inherent structure of the conflict description to detect irrationality in the behaviour of other parties, by induction of their motivations or powers from their points of view from the observation of their behaviour within the discrete state structure. As such it appears from the practical cases to be adequate. There is a need, however, for this multi-viewpoint view of conflict to be further investigated. For example, the knowledge of the different parties is in part constructed from exogenous information sources (observation or evidence) and from endogenous sources (sensemaking structures like the foveal approach). The availability of these latter structural supports to sensemaking alters the effectiveness of the former. One further research question is to identify the effect of proliferation of structural models upon sensemaking and effectiveness in strategic struggle. This question is analogous

to certain economics issues of common knowledge (Hirschleifer and Riley, 1992 pp 169-170, 218-219) in that if in a conflict management intervention we assume that the other player has at least as much information about the structure of the situation as we have, we may be failing to utilise an advantage which we have gained through investment in that understanding of the structure. Equally, we may well fail in the management of that situation if we make the complementary error of assuming a level of structural knowledge of the situation to be particular to us when it is in reality shared by our competitor. Such considerations bring into relief the relevance of the rationality considerations of Chapter 2. The first research topic in continuation, then is to determine the effect which structural understanding has on the interactive resolution of the conflict.

Related to that topic is the *ex post* examination of cases which show the disparate views of participants in a business conflict. This is notoriously difficult, because of the combination of commercial security considerations leading to an unwillingness to say anything about the decision making process for fear of giving away a commercial advantage in a similar situation together with the general lack of historical multi-viewpoint narrative of business conflicts. Nevertheless, a useful longer term research aim would be the tracking of the constructed viewpoints of participants over the development of a conflict in order to determine how important the differences in view were to the end result.

Decision support

It will be seen from the case studies presented that while the techniques of EFAR, top-down value-based state generation and Powergraph are not onerous in the contained examples cited here, if the complexity of a particular conflict were to be high, the work content of the analysis would rise dramatically. In practice, knowledge of this factor causes early effort to be put into appropriate simplification of the situation in the models, but it is likely that there will be some cases where directed graph structures of greater complexity might be beneficial. In these cases a decision support package would be of significant benefit. EFAR in particular, like its foundation, FAR, is time consuming when done by hand, and while practitioners have produced software support for their own use, these tend

merely to be accounting packages. An IKBS approach whereby a decision support system might make proposals on appropriate clustering in particular might be of considerable use.

Decision support, too, would allow the myopic planning difficulty of Powergraph to be addressed. We have already seen that inherent in the solution process of Powergraph is the assumption of how far the opponent will be able or willing to take into account the delayed gratification of moving to an intermediate state in order subsequently to achieve a more favoured position,. Like previous workers in the field (Howard, 1971, Fraser and Hipel, 1989) the assumption has been used here that delayed gratification in that sense is not a major factor because of the inherent risks of the intermediate state. Because the structures being managed here are not perfectly known the risks are all too evident to practitioners. There is a structural problem here, however, which is that a risk-prone opponent may be tempted to take a view of the game structure which allows for a planning horizon more than one or two steps in length. The boolean algebra of (Annex A) allows for this to be taken into account in terms of calculation of directed graph topologies, but the application of the boolean algebra technique described there is rather onerous, and decision support which allowed successive presentation of the directed graphs resulting from successively less myopic planning and motivation assumptions on the part of the players would be highly advantageous. It must be stressed, however, that no amount of calculation and decision support will avoid the fundamental difficulty that the assumption of an opponents' degree of planning myopia cannot be calculated. It is a matter of perception and judgement on the part of the informant. The rationality of behaviour on the part of the opponent is judged under certain assumptions of the opponent's objectives, and the degree of risk aversion is one of those assumptions. Nevertheless a decision support package which would allow investigation of the effects of different degrees of planning myopia would be an important addition to the technique, not least because it would allow heuristic investigation of the theoretical best outcomes for participants.

Relationship to complex systems

Lastly it is clear that there is a connection, at present only dimly seen, between this work,

which concerns itself with strategic issues and the body of work concerned with emergent behaviour. This literature concerns itself with economic system behaviour (Anderson et al, 1988; Saviotti and Metcalfe, 1991; Goodwin, 1992; Medio and Gallo, 1993) and with spatial systems such as the behaviour of cities (Allen and Sanglier, 1979; Sanglier and Allen, 1989; Hiller and Penn, 1992; Batty and Longley, 1994) and more general social structures (Allen, 1996).

It is possible that this work provides a useful intermediate structure lying between that of the myopic micro-actors and the overall implicit policy of the models. The approach provides the potential of representing the arbitrary strategic behaviour of actors at an intermediate level or levels. For example, let us take the case of understanding the political behaviour of micro-actors in respect of support or otherwise for environmental legislation. At one level, the national bodies, government and environmental agencies, can be seen setting the constraints on behaviour and the resources available for the micro-actors, within which bounds the latter will produce emergent behaviour in support of various legislative policies or otherwise. There is, however a level of constraint below that of the national body and yet more empowered than that of the micro-actor, namely the commercial bodies involved in environmentally sensitive activity. These bodies too are constrained by the policy of the top-level, strategic bodies, but they have tangibly greater spans of control and resources than the individual micro-actors, and, moreover have a collective will and policy-making capacity which is significantly greater than that of any single micro-actor. They are able to act in wholly different ways (compared with the national bodies and with the micro-actors) in response to the strategic policy expressed above them and the emergent behaviour from below them. For example, they can engage in civil process and they can lobby coherently. It is possible that the approaches described in this work will provide a basis for establishing the effect which this intermediate level of resource and policy span of control has upon the emergent behaviour of the system under question by allowing the expression of exogenously derived policy (from the intermediate level) upon the emergent behaviours of the conventional approaches.

Section VI: Supporting material

References
Annexes

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Annex A

Scenario Descriptions

BAe Alternate Naval Strategy Case - Chapter 6)

Index 1 1 1/2 1/2 1/2 1 1/2

In poor market conditions caused in part by its poor performance in managing risk, the company has lost customer confidence and adopts a belated survival policy which may well involve seeking a purchaser.

Index 2 1 1/2 1/2 3 1 1/2

Although the company's performance in containing risk on its major projects is adequate, this is not sufficient in the poor market conditions to sustain the confidence of the customer. With a vulnerable share price but reasonably well-performing projects the company becomes an attractive take-over target.

Index 3 1 1/2 3 3 3 1/2

In spite of poor performance in the project field, the company retains the loyalty of the customer, probably from a strategic industrial perspective. Nevertheless with such a low share price the company remains vulnerable to take-over, and in order to advance to more secure ground major improvements need to be made in project and related performance.

Index 4 1 1/2 1/2 3 3 3/4

Because of adequate risk containment on major projects and the loyalty of the customer, the market conditions are viewed as quite favourable, but the company remains under threat to take over, essentially because of a depression of the share price induced by a poor matching of skills with future project need.

Index 5 2 2 1/2 1/2 2 1/2

Absorbed into 1

Index 6 2 3/4 2 2/3 2/3 1/2

In spite of poor performance on projects and a fragile to weak market, the company attempts to maintain its existing configuration and objectives. Customer loyalty is fragile.

Index 7 2 3/4 3/4 4 2 1/2

The company's performance on its present major contracts is proving satisfactory, but this has not been translated into confidence in the customer community or in the stock market. As a result the company is forced into a limited set of objectives involving little more than maintenance of the present position with only limited possibilities for incremental advance.

Index 8 2 3/4 3/4 4 3 1/2

In spite of good performance on present projects, customer confidence remains low, leading to poor market prospects and a related depressed share price. The customer remains sceptical of future performance.

Index 9 2 3/4 3/4 4 3 3/4

Knowledge of the customer's scepticism of the company in spite of good performance on existing projects, and a satisfactory market projection leads to a depressed share price.

Index 10 2 3/4 2 3 2 1/2

Relatively poor performance on major projects, stemming from inadequate competencies (but with a portion of luck) leads to a lack of credibility in the market place, this in turn leads to poor market prospects, but management retain a view of improvement in internal performance so that incremental growth remains a possibility.

Index 11 2 3/4 2 3 3 1/2

Absorbed into 6

Index 13 2 3/4 2 3 3 1/2

In spite of a buoyant market the company's poor project performance depresses the share price. The poor project performance is related to inadequate core competencies.

Index 15 2 2 1/2 2/3 1/2/3 1/2

In the light of poor project performance, a weak market and lack of customer support, a limitation objective is adopted. Defence against take-over threats is marginally possible.

Index 16 2 2 1/2 2/3 3 1/2

Absorbed into 15

Index 17 2 2 1/2 2/3 3 3

Absorbed into 15

Index 19 2 2 1/2 2/3 3 3/4

Because of a buoyant market the company decides that it can sustain a limited survival objective in spite of its poor performance in project terms, reflected in poor customer loyalty.

Index 20 2 3/4 3/4 5 3/4/5 1/2

In spite of the company's good performance in projects, the very weak market conditions cannot sustain future prospects of a size adequate to satisfy the share holders. as a result the share price drops, but the company decides that it may be possible to trade out of such a position.

Index 22 2 3/4 3/4 5 3/4/5 3/4

Absorbed into 20

Index 34 3 3/4 2 2/3 2/3 2

Absorbed into 35

Index 35 3 3/4 2 2/3 2/3 3/4

In spite of weak customer support leading to poor market predictions, the company retains a view of the future based on steady growth.

Index 45 3 5 3/4 4 3 1/2

As a response to a weak market, and in then knowledge of good performance in existing projects, the company decides to engage in a repositioning exercise.

Index 47 3 5 3/4 4 3 3/4

Because of a good performance and future prospects the company decides to engage in an expansion exercise because of limited opportunities within its existing markets.

Index 48 3 5 3/4 4 3 4

Absorbed into 47

Index 54 4 4/5 2 2/3 2/3 3/4

The share price is satisfactory, and with a reasonably strong market prospect. the company decides to engage in a major shift and growth, recognising that investment will be needed to improve both actual and perceived performance on projects.

Index 57 4 4/5 3/4 5 4/5 2/3

The risk management investments begin to pay off and in the light of high customer confidence and an adequate market condition, the company engages in a decisive growth strategy.

Index 59 4 4/5 3/4 5 4/5 4/5

Heartened by strong market projections and with good prospects of being able to contain risk and perform well on major projects, the company engages in an aggressive development strategy.

Index 63 4 4/5 3/4 4 3 3

In the light of adequate market predictions, a reasonable performance in projects and confidence in the ability of its organisation, the company engages in an aggressive developmental strategy. (TODAY'S STATE)

Index 64 4 4/5 3/4 4 3 4

With a strengthened market the company builds on satisfactory performance in projects to develop an aggressive development strategy.

Index 70 5 4/5 4 5 4 3

The company performs excellently in risk management terms on major projects and customer confidence builds. As a result a strong developmental strategy is judged appropriate.

Index 73 5 6/7 4/5 4/5 4/5 3

In only moderately good markets predictions, the company feels that its excellent

performance in project risk management coupled with a strong level of confidence on the part of existing customers justifies a set of objectives which are global in nature and which represent a shift in the competitive environment.

Index 75 5 6/7 4/5 4/5 4/5 4/5

Every indicator shows the feasibility of a global/European expansion strategy.

Index 78 5 6/7 4/5 6 4 4/5

The outstanding project performance allows expansive strategic objectives to be entertained and the stock market supports such a view, as does the customer community.

Index 80 5 6/7 4/5 5/6 3/4 4/5

Absorbed into 79

Index 93 5 4/5 4 4 3 3/4

Although the performance of the company in existing projects is good, customer confidence remains cautious, and so a correspondingly limited set of development objectives are adopted.

Index 96 5 4 4 5 4/5 2/3

A weak market suppresses very expansive aims on the part of the company, which limits itself to consolidating its market performance and very good delivery on major projects.

Index 98 5 5 4 5 4/5 4/5

A strengthening market and healthy stock market position allows an ambitious strategy to be put in place. Customer confidence is high due to good performance in risk containment on major projects.

Index 101 5 6/7 4/5 5/6 5/6 2

Excellent performance both in the market and in major project terms, coupled with a poor market prediction induces a strategic plan based on major expansion into adjacent markets, and on a global basis.

Index 102 5 6/7 4/5 5/6 3/4

With a track record of performance in a static existing market, the company engages in an aggressive expansionist strategy on a global basis to allow further market exploitation.

Index 104 5 6/7 4/5 5/6 5/6 5

All indicators are set for a major global expansion programme. Nothing is going wrong.

Index 106 5 4 2/3 4 3 3/4

A market-led position where in spite of only adequate to good performance, sales opportunities expand, allowing the possibility of expansionist strategies which would not exist if the market predictions were weaker.

Annex B

Clustered Scenario Descriptions in Vicinity of Today (for BAe Alternate Naval Strategy Case - Chapter 6)

Index 6+7+8 2 3/4 2/3/4 4 2/3 1/2

The company's performance on its present major contracts is proving satisfactory, and may even be improving,, but this has not been translated into confidence in the customer community or in the stock market. As a result the company is forced into a limited set of objectives involving little more than maintenance of the present position with only limited possibilities for incremental advance. An additional major problem is a weakening market prediction.

Index 9 2 3/4 3/4 4 3 3/4

Knowledge of the customer's scepticism of the company in spite of good performance on existing projects, and a satisfactory market projection leads to a depressed share price.

Index 10+13+19 2 3/4 2 3 2/3 1/2

Relatively poor performance on major projects, stemming from inadequate competencies (but with a portion of luck) leads to a lack of credibility in the market place, this in turn leads to poor market prospects, but management retain a view of improvement in internal performance so that incremental growth remains a possibility. Customer confidence is high in spite of relatively weak delivery quality.

Index 35+47 3 3/4/5 2/3/4 2/3/4 2/3 3/4

In spite of weak customer support leading to poor market predictions, the company retains a view of the future based on steady growth.

Index 45 3 5 3/4 4 3 1/2

As a response to a weak market, and in the knowledge of good performance in existing projects, the company decides to engage in a repositioning exercise.

Index 54 4 4/5 2 2/3 2/3 3/4

The share price is satisfactory, and with a reasonably strong market prospect. the company decides to engage in a major shift and growth, recognising that investment will be needed to improve both actual and perceived performance on projects.

Index 59 4 4/5 3/4 5 4/5 4/5

Heartened by strong market projections and with good prospects of being able to contain risk and perform well on major projects, the company engages in an aggressive development strategy.

Index 57+63+64 4 4/5 3/4 4 3 3

In the light of adequate market predictions, a reasonable performance in projects and confidence in the ability of its organisation, the company engages in an aggressive developmental strategy. (TODAY'S STATE)

Annex C

Boolean Matrix approach

The approach to the solution or analysis of the Powergraph transition matrices or directed graphs of Chapter 7 is essentially graphically based, and more than suffices as a heuristic basis for practical analysis. An alternative approach is offered here, however, which puts the rationality algorithm on a more formal basis and which provides a possible basis for a computer embodiment of the method.

Powergraph solutions require the solution of networks of states, directed graphs, which are linked by motivated empowered transitions. The essential process is that of identifying the Boolean expression which describes the combinations of actions which are necessary and possible in order to bring about a transition. The abilities of participants in the game are expressed by a Boolean expression attached to each link between states and which describes the individual and combined capabilities of the participants to control that transition.

The resulting Boolean expression is then evaluated by setting to logical 0 those arguments which represent participants who are not motivated to bring about the transition. This motivation is described by a rank ordering matrix which, for each participant, places in order of preference each of the states. This process results in a motivated power matrix, being a matrix describing the combinations of participants who are both able and motivated to bring about the particular transition.

A solution of the game, then, is the identification of equilibrium states which are accessible from a start state, and which have no paths leaving them as described in the motivated power matrix. It can be seen that this is an extension of the Pareto equilibrium concept expanded by Nash, ubiquitous in Game Theory.

As described, however, the equilibrium process has a fundamental shortcoming, namely that the motivations of players are myopic in the sense that there is no appreciation that moving from state i to state j may well provide an immediate improvement, but a subsequent

move from state j to state k , under the control of a third party, may well result in a reduction of preference. See Figure 68.

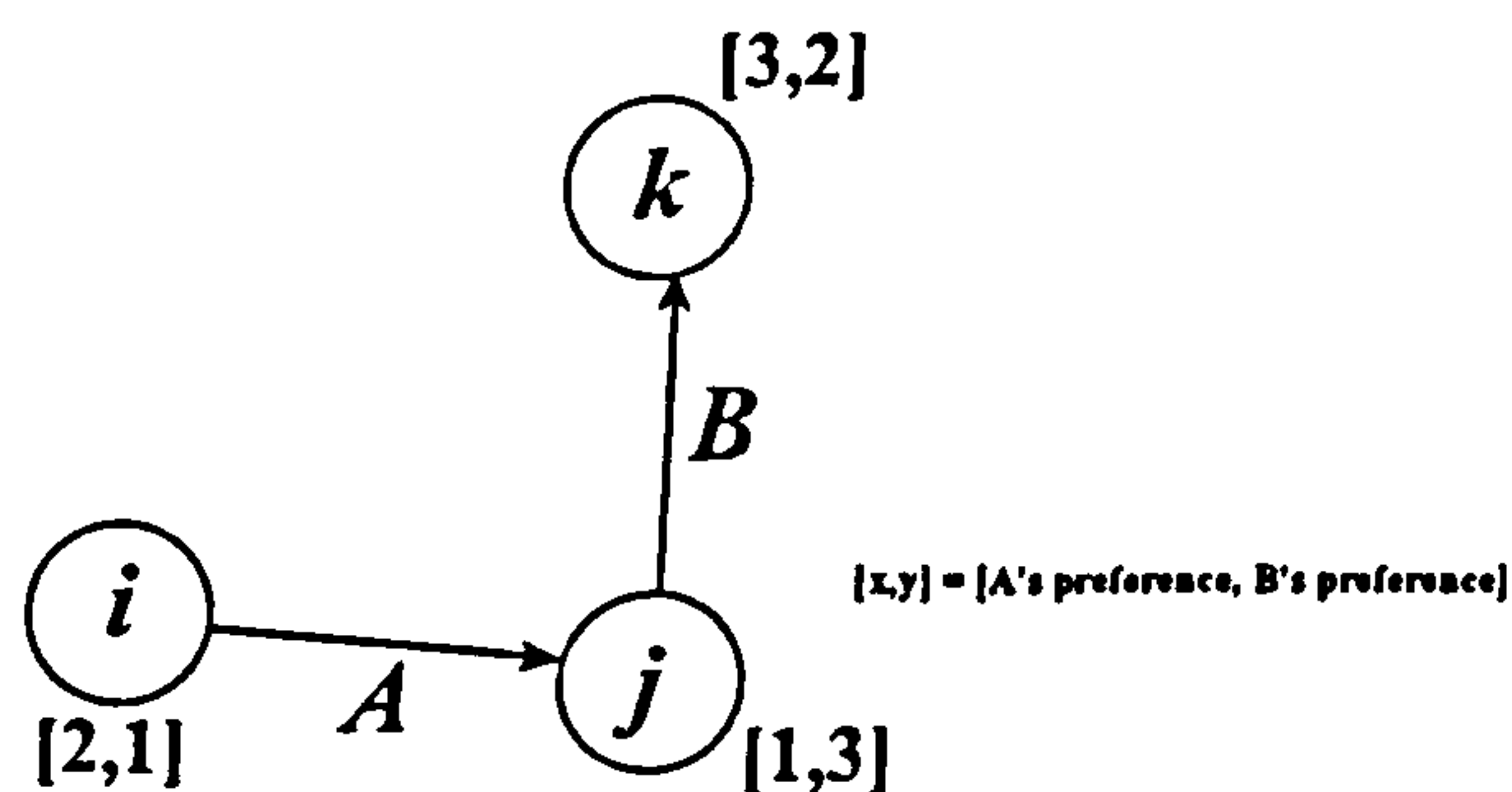


Figure 68: A is sanctioned by B . In moving to a myopically improved state (j), A should recognise that another party (B) can move to a third state (k) which A likes less than state i .

This is the well-known sanctioning process described by Howard and by Fraser and Hipel. Conversely, the myopic equilibrium-seeking described above fails to reflect the case where moving to an intermediate state which results in temporary reduction of preference may enable a later move to a better preferred state. In other words delayed gratification is not comprehended. See Figure 69.

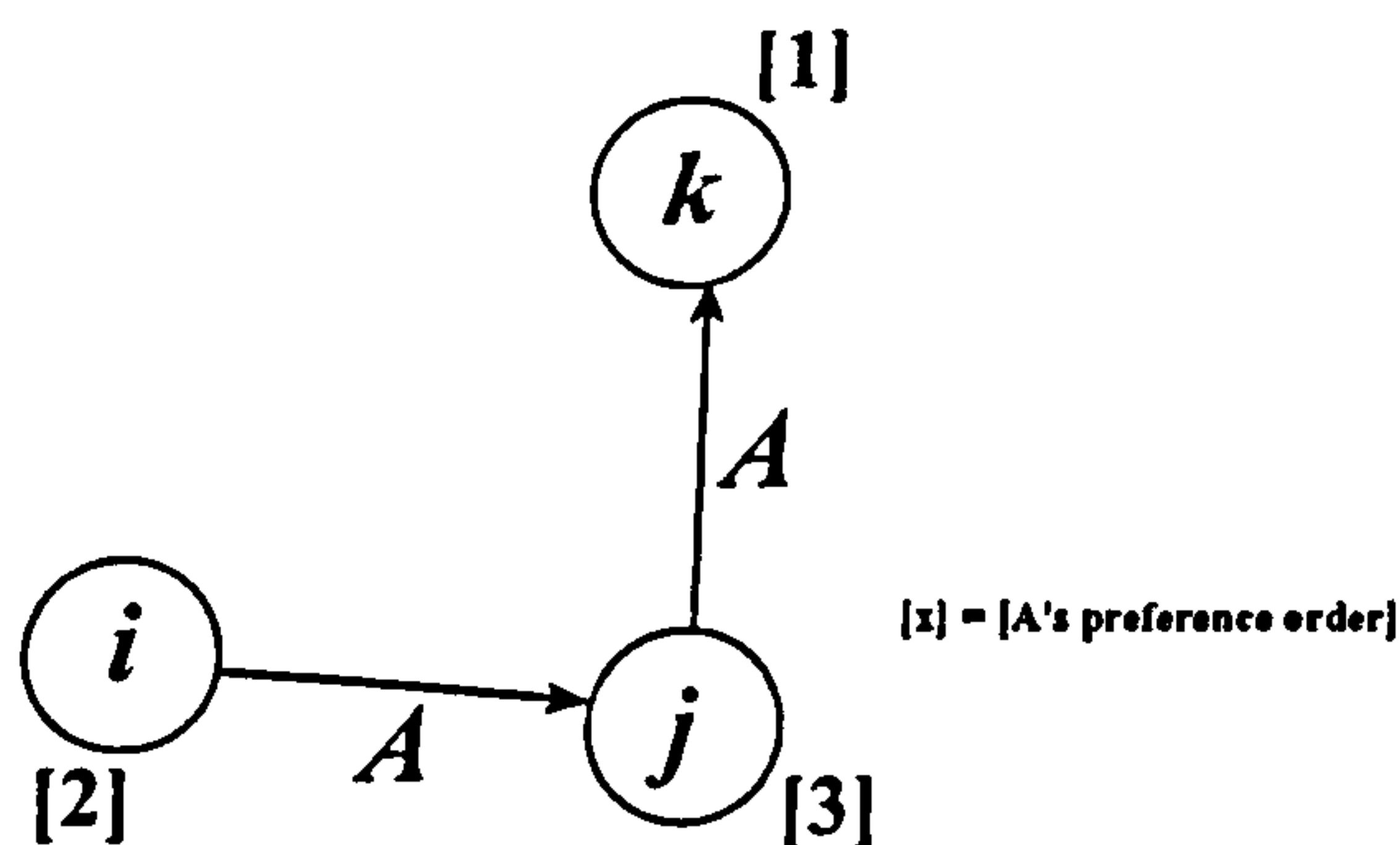


Figure 69: Delayed gratification. By moving down in preference (to state j) A allows a later improvement to k .

What is required, then, is a solution method which reflects the possible motivations of participants for transitions which encompass two or more steps through the directed graph.

Formal Definitions

A Powergraph game, $\Gamma (B, U, N, n)$ consists of a set of N states between any two of which transition may be possible. Player r is denoted by P_r . The feasibility of such transitions are expressed in the $N \times N$ Boolean matrix, B , whose elements, $b_{ij} (P_1, \dots, P_n)$ consist of boolean expressions which reflect the various powers of the n players of the game in controlling the transitions from state i to state j . The symbols $+$ and $.$ in the following refer, then, to boolean operations of OR and AND respectively.

The $N \times n$ array U is a preference ordering for each player, where the states are assigned an ordering number from 1 to N indicating the order of preference for each player for each of the N states. Thus preference order 1 indicates the best preferred state and preference order N the least preferred.

Motivated Power Matrix Generation

Each transition, $i \longrightarrow j$, then, has associated with it a Boolean expression, b_{ij} , and a pair of preference orderings for each player (1 to n), each a row vector of U ,

$u_{rk} (r \in \{i, j\}, k \in \{1, \dots, n\})$. We generate a motivated power matrix,

$$\begin{aligned} M^1 &= m_{ij}^1 \quad (i, j \in \{1, \dots, N\}) \\ &\text{where, for each player, } P_r \\ m_{ij}^1 &= b_{ij}(\dots P_{r-1}, P_r, P_{r+1} \dots P_n) \text{ iff } u_{jr} > u_{ir} \\ &= b_{ij}(\dots P_{r-1}, 0, P_{r+1} \dots P_n) \text{ otherwise.} \end{aligned}$$

Thus, if a player is not motivated to bring about the transition $i \longrightarrow j$, the component of the relevant boolean expression is set to logical 0.

Two-step Motivated Power

We now take into account the effects of sanctions and delayed gratification by considering alternative routes to any state. Consider three states i, j and k . Transitions can be made direct from i to j in one step or *via* state k , taking two steps. The transition from i to j direct is governed by m_{ij}^1 , above.

In order for the transition $i \longrightarrow k \longrightarrow j$ to take place, both $i \longrightarrow k$, (controlled by b_{ik}) and $k \longrightarrow j$, (controlled by b_{kj}) have to take place. We observe that transition $i \longrightarrow k \longrightarrow j$ is, therefore, governed by $b_{i(k)j} = b_{ik} \cdot b_{kj}$. Observe that there is an implication that the agreement between the parties described by b_{ik} and b_{kj} will be followed through; there is to be no reneging at an intermediate stage. The potential danger of this is comprehended by the building up of the equilibrium picture from one-step to N -steps. However, the motivation for participants to induce the two transitions together is motivated by the comparison between the preference ordering for i relative to j rather than any consideration of the intermediate state, k . Hence the component of the motivated power matrix concerned with the transition $i \longrightarrow k \longrightarrow j$ has a boolean expression

$$m_{i(k)j}$$

where, for each player, P_r

$$\begin{aligned} m_{i(k)j} &= b_{i(k)j}(\dots P_{r-1}, P_r, P_{r+1} \dots P_n) \text{ iff } u_{jr} > u_{ir} \\ &= b_{i(k)j}(\dots P_{r-1}, 0, P_{r+1} \dots P_n) \text{ otherwise.} \end{aligned}$$

We now observe that transition $i \longrightarrow j$ can be achieved not just *via* state k but *via* any other state (not i or j) in Γ . We are now in a position to describe the element of a motivated power matrix which takes into account that any transition $i \longrightarrow j$ can be achieved via any intermediate state k so long as we apply the preference ordering to the relative desirability of the states i and j . We define b_{i-j} as the boolean expression which describes the capabilities of the participants to control the transition from i to j *via* any intermediate state. Thus,

$$b_{i-j} = (b_{i1} \cdot b_{1j} + b_{i2} \cdot b_{2j} + \dots + b_{im} \cdot b_{mj} + \dots + b_{iN} \cdot b_{Nj}) + b_{ij},$$

which we can conveniently write as

$$b_{i-j} = \sum_{m=1, N} b_{im} \cdot b_{mj},$$

with the understanding that $+$ and \cdot are boolean operators rather than arithmetic ones.

We now define an operator $*$, analogous with matrix multiplication which operates over (square) boolean matrices. We define $*$ by :-

$$\text{If } Z = X * Y$$

$$z_{ij} = \sum_{m=1, N} x_{im} \cdot y_{mj} \cdot$$

It can be easily seen that $*$ is non-commutative unless both X and Y are symmetrical. It is, however, associative. *See* Theorem 1.

Let us now consider the matrix $B^{(2)}$, the elements $b^{(2)}_{ij}$ of which define the boolean expression controlling transitions between states i and j in two steps or fewer. Then

$$b^{(2)}_{ij} = b_{ij} + b_{i,j}.$$

In matrix terms, using the operator defined above, then, we have

$$B^{(2)} = B + B * B,$$

which for notational convenience we write as $B^{(2)} = B + B^2$.

N-step transitions

Theorem 2 shows that the boolean matrix describing the control of the participants over transitions between states in M steps or fewer is given by

$$B^{(M)} = \sum_{k=1, M} B^k \quad \forall \ M \leq N,$$

again, with summation being by OR and matrix multiplication defined as $*$ above.

Contribution to solution of a Powergraph network - depth of equilibrium

The series $B^{(M)} = \sum_{k=1, M} B^k$ constitutes a polynomial in B , the term of which represent the powers applicable to the movement between two states in a specific number of moves. If we calculate, then, for any network the series of motivated power matrices,

$$\begin{aligned} M^{(k)} &= m_{ij}^{(k)} \quad (i, j, k \in \{1, \dots, N\}) \\ &\text{where, for each player, } P_r \\ m_{ij}^{(k)} &= b_{ij}^{(k)}(\dots P_{r-1}, P_r, P_{r+1} \dots P_n) \text{ iff } u_{jr} > u_{ir} \\ &= b_{ij}(\dots P_{r-1}, 0, P_{r+1} \dots P_n) \text{ otherwise,} \end{aligned}$$

we have a series of matrix representations of potential equilibrium states at path lengths 1, 2, ... $k, \dots, N-1$. These equilibrium states are characterised by two features:-

- 1) they must be accessible
- 2) they must have no motivated and empowered path leading from them.

(This does not imply that, in practice, no other state can be a rest state. Non-equilibrium states can be temporarily accessed, and the time spent at these states can be substantial. Secondly, one observes that errors in the data, particularly in the utility matrix, U , which encompasses the perceptions of participants other than the client-actor, can result in different equilibriums in practice.)

These two requirements are satisfied respectively for a state σ if

$$1^* \quad b_{i\sigma}^{(k)} \neq 1 \quad \text{for some } i$$

$$2^* \quad m_{\sigma j}^{(k)} = 0 \quad \forall j.$$

The depth of an equilibrium is defined as the lowest value of k at which 1* and 2* above are satisfied.

Theorem 1

The operator $*$ is non-commutative and associative

Proof

1. $*$ is non-commutative

Consider $Z = X * Y$.

$$z_{ij} = \sum_{k=1, N} x_{ik} \cdot y_{kj}$$

Consider $W = Y * X$

$$\begin{aligned} w_{ij} &= \sum_{k=1, N} y_{ik} \cdot x_{kj} \\ &= \sum_{k=1, N} x_{kj} \cdot y_{ik} \end{aligned}$$

Then $z_{ij} = w_{ij}$ iff

$$x_{pq} = x_{qp} \quad \forall p, q \text{ and}$$

$$y_{pq} = y_{qp} \quad \forall p, q.$$

Hence $X * Y = Y * X$ iff both X and Y are symmetrical.

2. $*$ is associative

Consider $Z = A * (B * C)$

$$\begin{aligned} z_{ij} &= \sum_{k=1, N} a_{ik} \left(\sum_r b_{kr} \cdot c_{rj} \right) \\ &= \sum_{k=1, N} \sum_{r=1, N} a_{ik} b_{kr} c_{rj} \\ &= \sum_{k=1, N} \left(\sum_{r=1, N} a_{ik} b_{kr} \right) c_{rj} \end{aligned}$$

Hence $Z = (A * B) * C$

Theorem 2

$$\mathbf{B}^{(M)} = \sum_{k=1, M} \mathbf{B}^k$$

Proof

The proof is by induction.

$$\text{Assume that } [H_M]: \mathbf{B}^{(M)} = \sum_{k=1, M} \mathbf{B}^k.$$

$$\text{Now, } b_{ij}^{(M+1)} = b_{ij} + \sum_{t=1, N} b_{it}^{(M)} \cdot b_{tj}$$

since we can traverse the path in one step or by a path of length between 1 and M with a path of length 1 added to it, *via* an intermediate state t .

$$\text{Hence, } \mathbf{B}^{(M+1)} = \mathbf{B} + \mathbf{B}^{(M)} \cdot \mathbf{B}$$

$$\begin{aligned} \text{Therefore, } \mathbf{B}^{(M+1)} &= \mathbf{B} + \left(\sum_{k=1, M} \mathbf{B}^k \right) \cdot \mathbf{B} \\ &= \sum_{k=1, M+1} \mathbf{B}^k \end{aligned}$$

Therefore $H_M \Rightarrow H_{M+1}$, but we know that H_2 is true, since

$$\mathbf{B}^{(2)} = \mathbf{B} + \mathbf{B} * \mathbf{B} = \mathbf{B} + \mathbf{B}^2 = \sum_{k=1, 2} \mathbf{B}^k$$

But $H_2 \Rightarrow H_3$ and $H_3 \Rightarrow H_4$ etc.

Hence H_M is true for all finite M

Theorem 3

$$\mathbf{B}^{(M)} \equiv \mathbf{B}^{(N)} \quad \forall M > N$$

Proof

$$\mathbf{B}^{(M)} = \sum_{k=1, M} \mathbf{B}^k$$

$$\text{So that } b_{ij}^{(M)} = b_{ij} + b_{ij}^{(2)} + \dots + b_{ij}^{(M)}$$

$$= b_{ij} + \sum_{k_1=1, N} b_{ik_1} \cdot b_{k_1j} + \sum_{k_1=1, N} b_{ik_1} \cdot \sum_{s=1, N} b_{k_1k_2} \cdot b_{k_2j} + \dots + \sum_{k_1=1, N} b_{ik_1} \dots \sum_{k_{M-2}=1, N} b_{k_{M-3}k_{M-2}} \cdot b_{k_{M-2}j}$$

This can be seen as a series of boolean terms covering the possible paths between states i and j passing through all other states.

Thus, each term of $b_{ij}^{(N)}$ consists of a series such as

$$b_{ij} + \{b_{is} \cdot b_{sj}\} + \{b_{ir} \cdot b_{rv} \cdot b_{vj}\} + \dots + \{b_{iz} \dots b_{wj}\}$$

where $\{\dots\}$ denotes that all combinations of paths from i to j are covered.

Thus, since

$$b_{ij}^{(N+1)} = \sum_{k=1, N} b_{ik}^{(N)} \cdot b_{kj}$$

we can see that every b_{kj} appears already in some element of $b_{ik}^{(N)}$. We can write

$$b_{ik}^{(N)} = f \cdot b_{kj} \cdot \phi, \text{ where } \phi \text{ and } \phi \text{ are boolean expressions.}$$

$$\text{Hence, } b_{ik}^{(N)} \cdot b_{kj} = \phi \cdot b_{kj} \cdot \phi \cdot b_{kj} = \phi \cdot b_{kj} \cdot \phi,$$

$$\text{so that } b_{ij}^{(N+1)} \equiv b_{ij}^{(N)} \text{ if } M \geq N$$

Annex D

From Chapter 10

OSF strategic analysis.

Notes on compatibility of sector values

O vs. F

The present two sites are only acceptable to OSF if there are insufficient funds to make a change. Improving the communications between the existing sites is viewed as an inadequate but possibly temporary expedient. If funds become available single site working, possibly with a central London site, is highly desirable. Significant funds are required to relocate either to a provincial site or to a single London site. The latter requires substantially greater investment.

D vs. O

A single London site would undoubtedly lead to a good delivery performance.

D vs. F

There will be a strong correlation between delivery performance and available funds, although availability of funds will be affected by other factors.

E vs. D

We should expect a strong correlation here; the customers are aware of supplier performance and are strongly communicative.

E vs. O

Little connection here other than the *status quo* will not support a greatly enhanced customer perception (*possible second order effect here*)

E vs. F

An improved customer perception will lead to availability of funds through market pressures (assuming, of course, that OSF can accept an enlarged throughput).

S vs. E

An adequate perception is required to encourage any shareholder to buy in.

S vs. D

The present share holding position could in theory support any level of delivery performance, but exchanging minority shareholders would require a confidence in the incomers that the existing management could support the market. On the other hand a new majority shareholder may consider that significant improvement could be induced by a change in ownership.

S vs. O

A buyer will be uncaring about the organisational position whereas a major investor will be concerned with buying into a coherent and viable business.

S vs. F

Any major ownership change will bring development funds.

A vs. S

The only feasible routes for exit are by a complete sale or by a majority share ownership deal.

A vs. E

To maximise the value a good external perception is required, but a poor market performance reflects the option of a distress sale. To obtain an increased market share improved performance will be required.

A vs. D

While a sale can be achieved with any performance, growth is only possible with an improved performance in delivery.

A vs. O

A sale can be achieved under essentially any organisational configuration but some site arrangements will not allow high levels of performance. In order to achieve security single site working is deemed necessary.

A vs. F

Clearly ambition and financial resources go together, both by cause and effect.

C vs. A

The extent to which the competition is willing to accommodate OSF in their plans is crucial to the market penetration. Similarly if OSF is not active in the market competitors will not be interested in accommodating OSF.

C vs. S

OSF is unlikely to disengage if the competitive environment is promising.

C vs. E and D

Competitors are unlikely to view OSF as a target unless delivery is good. The *status quo* can remain tough, under any delivery condition.

C vs. O

No correlation

C vs. F

The level of competition is likely to work against OSF's cash flow and hence availability of funds.

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Annex E
(from Chapter 10)

OSF Strategic Analysis

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Table 69: Distances between states

